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ESSAYS ON DECEPTIVE COUNTERFEITS IN SUPPLY CHAINS: A BEHAVORIAL PERSPECTIVE

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ESSAYS ON DECEPTIVE COUNTERFEITS IN SUPPLY CHAINS: A BEHAVORIAL PERSPECTIVE

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by
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Abstract

This dissertation is comprised of three essays intended to contribute to the operations management discipline, specifically within supply chain management. The first essay provides a research agenda for studying deceptive product counterfeits, which are products that have been manufactured and/or distributed and sold by an entity in violation of another's intellectual property rights and intentionally misrepresented by the seller as the genuine article. The proliferation of counterfeits into legitimate supply chains presents quality, health and safety and cost concerns for nearly all industries. We identify antecedents of vulnerability to deceptive counterfeits for firms and their supply chain partners using Situational Crime Prevention Theory and Normal Accident Theory. Vulnerability to counterfeiting has negative performance impacts for the firm, its customers and society. We propose using the Six Ts of Supply Chain Quality Management (Roth, Tsay, Pullman and Gray, 2008) as an approach to select effective strategies to mitigate these impacts.

Essay Two serves as an initial effort to understand how counterfeits can enter supply chains. In this essay, we test whether purchasing specialists can serve as effective guardians of the supply chain using a scenario based role playing experiment. We explore if buyers can detect signals of counterfeits in proposals and successfully avoid the counterfeit supplier in the decision process. We additionally examine whether time constraints and workload pressure detracts from the ability to successfully process signals and avoid the counterfeit. We find that the buyers can successfully detect counterfeit

signals and avoid the counterfeit in the selection decision, but don't find support for time constraints and workload pressure effects.

The final contribution of this dissertation is a methodological essay that explores the effect of time pressure on decision making by using a combination of perceived time pressure and objective measures of time spent in the decision process to determine if time pressure affects the quality of the decision making in a supplier selection decision. We find that time constraints and perceived time pressure are related constructs that negatively affect decision quality in a supplier selection decision.

Dedication

This work is dedicated to my wonderful parents, Joanne and William Davis, III, the love of my life, my husband, Ken, our son, K.C., our daughter, Ella, my bonus daughters: Maddie, Rylee, Hannah & Kaitlyn, my siblings: Bill, Melissa, & Corinne, the O'Nan family (who taught me to love Clemson and let us live in their home), and my friends and colleagues in the Department of Defense and Clemson University.

It is finally in honor of my grandmother, Regina T. Simurda, who passed into eternity during my years as a student at Clemson University. She has been keeping constant vigil and smiles down as the guardian angel of this effort. Early in life, she taught me the importance of education and lifelong learning, teaching me that the mind is a gift that is immeasurably valuable and can never be taken away from a person. May this and all my future academic achievements be in honor of the wonderful woman that she was in this life and is now in Heaven with God; the Father, the Son and the Holy Spirit.

I thank each and every person who devoted their time, effort and hearts to love, encourage, and support me throughout this arduous process. Words cannot express the immense gratitude and love I have for all of you. Always Penn State Proud and forever a Clemson Tiger!

With humblest thanks and sincerest appreciation,

Jillian Theresa Watson

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If it takes a village to raise a child, then it takes a small city to produce a Ph.D. There are many people who contributed to the production of this manuscript. Most notably, I must thank my committee members who have been with me on this long journey that involved many pauses and restarts. Dr. Roth and Dr. Fredendall, have been patient beyond words with the starts and stops on the journey and helped me stay focused when I was wandering off track. I could not have done this without your guidance and encouragement. Dr. Schultz, you understand the challenges that being an academic in a world of warriors presents and I am so grateful for all the times when you were able to bring us out of the weeds and give an independent view of the issue. Dr. Switzer, thank you so much for joining us as our fourth and providing such clarity on how individuals perceive time and workload pressures.

Beyond my committee, I must thank the many people who participated in the experiment portion of the research. Were it not for the willingness of the Logistics Officers Association (LOA) to serve as a sample pool for this research, this dissertation would not have been possible. I am so proud to be a member of LOA and look forward to working with our community to continue to shape the logistics and acquisition environment in the Department of Defense.

In addition to the formal experiment sample, many people contributed to the refinement of the constructs and instruments used in this research. Thank you to Christine Metz, Henry Livingston, John Spicer, David O'Nan, Diane Nagel, Brent Polglase, and

Carol Johnson who served as subject matter experts in counterfeit research, supply chains and logistics and purchasing.

Once we had an initial instrument, we were able to pilot test it with the help of Dr. David Hall, Dr. Tom Zagenczyk and Dr. Sri Sridharan and their graduate students, who facilitated this research by serving as three sets of participants for the purposes of developing and refining our experiment.

Last but not least, I must thank my fellow doctoral student colleagues in the operations management concentration at Clemson University. You have made me a better person and a better academic through working alongside you in classes and seminars, in research assistantships and conference preparations. The journey has been a great adventure because we were on it together through the years. David Hall, Tracy Johnson-Hall, Enrico Secchi, Qiong Chen, Sriram Venkatramen, Niratch Tungtisanon, Min Lee, Yunsik Choi, Brandon Lee and Remi Charpin…we few, we happy few…you will always be my Band of Brothers.

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Chapter 1

Introduction

Product counterfeiting is the unauthorized reproduction of goods that are protected as the intellectual property of another entity (Cordell, Wongtada & Kieschnick, 1996; Shultz and Saporito, 1996). Practitioner literature, government reports and the media frequently highlight serious consequences for consumers, firms, and society from the proliferation of counterfeit goods (Phillips, 2005; Parloff, 2009; OEDC, 2009; SASC, 2012; CBP, 2012; European Commission, 2012). Infiltration of counterfeit parts and components is a critical problem for emerging and established markets worldwide. Supply chain managers are charged with the responsibility of ensuring a safe and secure supply chain, and the purchasing department plays an essential role in this task through its work in obtaining required materials for the operations of a supply chain.

One example of the potential financial impact of product counterfeiting within a business to business context comes from the defense sector, particularly in the area of electronic components. As highlighted in a Senate Armed Services Committee (SASC) report in May 2012, the federal government had to spend $4.5 million to remove counterfeit parts for one of its missile defense systems (SASC, 2012). In addition to the costs of addressing counterfeits that firms face, an even greater concern is one of user/consumer health and safety. Perhaps one of the most heartbreaking examples is from China, where counterfeit infant formula caused the malnourishment, illness and

subsequent deaths of more than 50 children in Fuyang city (McDonald, 2009). In addition to the health and safety concerns associated with counterfeits are concerns regarding the exploitation of vulnerable populations, including children, in unsafe work conditions to produce counterfeit goods for minimal pay in sweatshop conditions (Boniface, 2010; Thomas, 2009). The aforementioned examples illustrate a few of the cost, health and safety risks, associated with counterfeit goods. There is a combined effort on the part of governments, industry groups, and individual firms to address the counterfeit problem. Firms are rising to this challenge by investing in ways to control and track their goods and supplies, improving traceability of product origins by developing databases for reporting, tracking and seizing counterfeit goods; and by educating consumers and supply chain partners on how to identify counterfeit copies of their products (Staake and Fleisch, 2008; Berman, 2008).

As we examined the extent literature to understand the counterfeit phenomena, five research questions emerged that this dissertation seeks to address in order to improve the supply chain management discipline's knowledge in this area. The specific questions are:

1. What are the aspects of supply chains that make them vulnerable to the infiltration of counterfeits?
2. What are the impacts of counterfeits in supply chains?
3. What can be done to address the problem from a supply chain perspective?
4. How can supply chain and purchasing specialists help firms prevent the infiltration of counterfeits into supply chains?

5. What effects do time and workload pressure have on the quality of the purchasing decision outcome?

The dissertation is structured into three essays with three intended contributions. In Essay One, we develop a conceptual model to identify the sources of vulnerability to counterfeits entering legitimate supply chains and the impacts of counterfeits for firms, consumers and society, and offer a proposed agenda for research to understand and mitigate the possible negative outcomes that are the result of deceptive counterfeits. In developing our agenda, we include relevant theories that can be used as a lens to examine this issue, including Signaling Theory (Spence, 1974; Mavlanova and Benbunan-Fich, 2010), Crime Prevention Theory (Speier, Whipple, Closs and Voss, 2011), Normal Accident Theory (Perrow, 1984), High Reliability Theory (Weick, 1987) and Deception Theory (Bowyer, 1982; Whaley, 1982; Bell and Whaley, 1991). We then use the Six Ts of Supply Chain Quality Management (Roth et al., 2008) to offer a typology of relevant strategies to help prevent counterfeits from entering supply chains.

The second contribution of this dissertation, and focus of Essay Two, is to use a behavioral operations perspective to examine the role of purchasing specialists as guardians of the security of supply chain by conducting a scenario based role playing experiment to determine if they can detect signals of counterfeits and avoid the counterfeit supplier in a purchasing decision. Following the logic of Crime Prevention Theory as applied to supply chains (Speier et al., 2011), we propose that purchasing specialists serve as guardians of the supply chain, so it is essential to understand if they can detect signals of counterfeits in proposals and avoid selecting offerors whose

proposals contain counterfeit signals. This essays extends research on deceptive counterfeits into the business-to-business purchasing situation. Prior experimental research into the phenomena was conducted in the marketing discipline to address consumer behavior in e-commerce situations (Mavlanova and Benbunan-Fich, 2010). As part of our experiment, we examine if time pressure and workload pressure considerations affect the ability to detect the counterfeit signals.

The final contribution of this dissertation is primarily focused on understanding the effects of time pressure, both actual constraints on time and perceptions of time pressure, on the quality and accuracy of decision making. This essay uses data gathered during the experiment that is the focus of Essay Two and employs structural equation modeling to examine the relationship of perceptual assessments of time pressure and measures of the observed amount of time spent in decision making to determine if these are strongly related to one another. Additionally, we examine whether these two approaches to assessing time pressure are valuable in terms of their relationship actual time constraints and decision quality.

The remainder of this essay is structured as follows. Chapter 2 is our conceptual piece, Essay One, entitled "Deceptive Counterfeits: A Supply Chain Quality Management Research Agenda". It is followed in Chapter 3 by our experimental contribution, Essay Two, which is titled "Avoiding Deceptive Counterfeits: A Behavioral Experiment Informed by Signaling and Crime Prevention Theories". Our structural equation modeling effort on time pressure is the focus of Essay Three, "Objective versus Perceptual Measures of Time Pressure: An Exploratory Methodological Note". We

summarize our dissertation conclusions and recommendation for future research in Chapter 5. Attached to the back of this dissertation are two appendices containing the detailed typology findings from Essay One and the experimental scenarios and questionnaire used in Essay Two, as well as a listing of References used throughout this work.

Chapter 2

Essay One: Deceptive Counterfeits: A Supply Chain Quality Management Research Agenda

2.1 Introduction

Product counterfeiting, or the unauthorized reproduction of goods that are protected as the intellectual property of another entity (Cordell, Wongtada & Kieschnick, 1996; Shultz and Saporito, 1996), is a critical problem for supply chains in all industry sectors in both emerging and established markets around the globe. The challenge for supply chain managers is to ensure a safe and secure supply chain, end-to-end, for their downstream customers in both business-to-business (B2B) and business-to-consumer (B2C) relationships.

From a B2B perspective, the clearest examples of product counterfeiting can be seen in the defense aviation sector, particularly in the area of electronic components. The costs for remediation of the problem of counterfeits in these supply chains are staggering. As detailed in a Senate Armed Services Committee (SASC) report in May 2012, the Missile Defense Agency and its contractors had to invest $4.5 million in reworking as a result of counterfeiting (SASC, 2012). That is just one defense agency's costs. Given that the SASC identified more than 1800 cases of suspected counterfeits in the U.S. Department of Defense's supply chains, it is evident that the cost grows substantially. As

a result of the SASC findings, the U.S. Congress added requirements to the National Defense Authorization Act of 2012 that it is the responsibility of contractors (supplying firms) to bear the costs associated with correction of counterfeit problems unless specific criteria are met (NDAA, 2013).

In addition to the costs of addressing counterfeits that firms face, the other major concern is one of user/consumer health and safety, which is particularly true in the area of counterfeit pharmaceuticals. One of the more striking examples of the problem was reported in *Smithsonian Magazine*, detailing how the Chinese-made anti-malarial drug, artesunate, was being counterfeited on a major scale, with perpetrators selling blister packs that look like the legitimate medicine but that were made solely of flour (Marshall and Battambang, 2009). The people who need this medication are in developing countries such as Cambodia where malaria is a highly fatal disease. While the legitimate drug is produced in China, so too was the counterfeit packaging used to defraud innocent people who need this drug. While some of the people involved in this incident were prosecuted by the Chinese government, the manufacturer of the counterfeits was never identified, and most of the 240,000 counterfeit packs were never recovered, probably making their way into the market in Southeast Asia. This is not an isolated incident. In the early 2000s in Nigeria, counterfeit medicines for the treatment of HIV, malaria and other diseases were sold on the street by "hawkers" (Phillips, 2005).

As evidenced by these examples, counterfeit products present a host of cost, health and safety risks, impacting countries around the globe, so there is a growing focus within industry and government on eradicating this problem from infesting licit supply

chains. Government and industry groups are trying to work with one another to improve enforcement of criminal penalties and to make the distribution of counterfeits more difficult, but as the problem is still present, companies need to take actions to secure their supply chains from product counterfeit infiltration. Firms are rising to this challenge by investing in ways to control and track their goods and supplies, such as RFID technologies; by working with anti-counterfeiting initiatives sponsored by governments and industry groups, such as developing databases for reporting, tracking and seizing counterfeit goods; and by educating their customers on how to identify counterfeit copies of their products.

To support the efforts by practitioners to address the counterfeiting problem that consumers, businesses and governments face, there are three basic research questions that the supply chain management discipline should seek to answer:

1. What are the aspects of supply chains that make them vulnerable to the infiltration of counterfeits?
2. What are the impacts of counterfeits in supply chains?
3. What can be done to address the problem from a supply chain perspective?

The objective of this chapter is to begin to answer these questions. To do so, we develop a conceptual framework for the exploration of product counterfeits in supply chains. The framework includes the definition of a construct called "vulnerability to product counterfeits" and explores the antecedents of this vulnerability. These antecedents are a combination of product and supply chain factors, including aspects that are specifically related to conducting supply chain operations in emerging markets.

Additionally, our framework offers propositions for the relationship between vulnerability to product counterfeits and business performance outcomes, including loss of demand and costs of remediation of counterfeits. To answer the third question, we present a summary of proposed strategies in extant literature and use the High Reliability Theory as the basis for propositions that the Six Ts of Supply Chain Quality Management (Roth, Tsay, Pullman and Gray, 2008) can be used as the anchors for strategies to combat counterfeits in supply chains.

2.2 Background

Sources and Distribution of Product Counterfeits

The U.S. Customs and Border Protection and the European Union's border control agents have a long history of seizing product counterfeits and pirated goods as part of their inspections for IPR violations. From 2001 to 2011, there were a total of 550,729 identified cases of IPR violations in the United States and the European Union (EU) (CBP, 2012; European Commission, 2012). While this seems a staggering number and the trend is increasing, it is likely that many more counterfeits enter markets than are seized. Estimates on the magnitude of counterfeiting in the world economy suggest it to be 2% of the world trade in goods, amounting up to approximately $250 billion in 2007 (OEDC, 2009).

A continued look into these data reveals that a large portion of counterfeited and pirated goods originate or are transshipped from China and other countries with emerging markets. In the EU, the greatest portion of counterfeit and pirated goods that are seized, reported as a percentage of the total number of articles seized, originate from China

(72.95% of cases in 2011), with Hong Kong (7.67%), Greece (4.79%) and India (3.29%) rounding out the top exporting countries for pirated and counterfeit goods (European Commission, 2012). In the US, the greatest portion of pirated and counterfeit seizures, reported as a percentage of the total number of cases, come from China (55% of CBP seizure cases in 2011), followed by Hong Kong (27%) and Turkey (2%) (CBP, 2012). While the US percentage for China seems low for 2011, it is plausible that some items originating in China are transshipped via other countries such as Myanmar, Dubai, United Arab Emirates, and Nigeria (UNODC, 2008).

Counterfeiting – A Double-edged Sword for Emerging Markets

Emerging markets are defined as countries that are experiencing rapid growth and advancement in industrialization. International firms are leveraging the opportunities within these markets by outsourcing production, distribution and service activities to these nations, with the hope of reducing the costs of products made for domestic and foreign consumption. In their efforts to expand into these markets, firms share their intellectual property in a variety of ways, from sharing patented manufacturing processes and specifications, dyes, molds, and models, to sharing trademarked packaging and brand images for use in the production and distribution of products. Unfortunately, the level of intellectual property rights (IPR) protection at the national and local level varies greatly in these markets. Additionally, worker rights and health and safety protections may not be to the level expected in the firm's home country.

Companies and governments in emerging markets are eager to grow their business and economy, but there are some firms and individuals who are willing to do so

at the expense of intellectual property rights of their partners as well as at the expense of human rights and consumer safety, and counterfeiting products is one way they achieve this goal.

Counterfeiters do not limit their sales to foreign countries; they sell the goods in their own nations as well, putting the health and safety of the local populace at risk. In 2009, the Chinese government arrested 24 people for the production and sale of counterfeit baby formula that led to the malnutrition and deaths of more than 50 children in Fuyang city (McDonald, 2009). Additionally, counterfeit producers will force workers, including children, to endure long hours for minimal pay in sweatshop conditions (Boniface, 2010; Thomas, 2009). The people taking these jobs generally face poverty or are the victims of human trafficking.

The staggering facts about product counterfeiting can leave even the most callous feeling somewhat uneasy and disturbed, and while we hope that everyone can understand the consequences of the proliferation of the counterfeit economy, the method we chose to help address the problem was to explain how supply chain academics and practitioners can begin to examine the antecedents of supply chain vulnerability to counterfeiting as well as explain some of the potential effects of counterfeits on supply chains.

Identification of the gap in supply chain research

Despite this growing call to action on the part of industry and government, there exists only a limited amount of academic research in the supply chain management discipline dedicated to explaining what factors in supply chains allow for the infiltration of counterfeits; quantifying the risks associated with counterfeits, both the probabilities of

occurrence and the magnitude of impact; and the resultant effect on supply chain performance outcomes. Other disciplines have examined counterfeiting from a marketing and economic perspective, but none from a supply chain security and quality perspective (see Tables 2.1 and 2.2 and Appendix A for specific details).

The overarching intended contribution of this chapter is to serve as a theoretical and conceptual development piece that articulates the relevance and contemporary importance of studying product counterfeiting in supply chain management research. Our specific objectives for this effort are to present an overview of product counterfeiting and the magnitude of this problem, discuss the current state of supply chain literature, identify the gaps that exist in the area of product counterfeits, present a conceptual framework for examining counterfeiting in supply chains, offer a research agenda for product counterfeiting in the supply chain management discipline, and recommend potential theoretical lenses that can be used to evaluate this issue.

2.3 Construct Definition and Differentiation

To examine the current body of knowledge on product counterfeiting, particularly as related to supply chain management, we first conducted a review of the literature within the management discipline to identify the current state of the discipline's research in this area. Within the operations management literature, we found a limited initial set of investigations related to counterfeiting (Stevenson and Busby, 2015; Cho, Fang and Tayur, 2015). We also found calls to study counterfeiting as part of the broader issue of supply chain security (Flynn, 2008; Maruchek, Greis, Mena, Cai, 2011). We then expanded our research to include works from other disciplines to achieve a more holistic

view of the subject. Our review indicates a very limited amount of research that has been conducted in the management discipline, but a far greater base of knowledge in other fields, particularly in marketing and business economics. The goal of our literature review was to serve as a grounding for our key constructs and to identify different lenses that might be relevant for exploring this problem from a supply chain management perspective.

Construct Definitions for Product Counterfeiting

Product counterfeiting is a long-standing problem with one of the earliest attempts in history being a stopper for a Roman wine amphora, dated 27 BC, in Arles, France (Phillips, 2005), so that locally made French wine could be counterfeited and sold as the more expensive Roman varietal. Equally longstanding is the history of currency counterfeiting, which demonstrates the need first to differentiate and distinguish our focus area, product counterfeiting, from related topics. Counterfeiting, which broadly speaking, is the imitation of another item, be it a product, monetary instruments (currency or checks) or signatures, is classified as a type of intellectual property rights infringement (Staake, Thiesse and Fleisch, 2009). In addition to counterfeiting, intellectual property rights infringements include digital piracy, illicit parallel imports and patent violations (Staake et al., 2009).

In academic research, a thorough literature review in the area of counterfeiting was completed by Staake et al. in 2009, including an assessment of academic and industry publications from 1976 to 2006. This review provides definitions for counterfeiting and related terms. Figure 2.1 depicts their classification scheme for terms

related to counterfeiting. Counterfeiting is a subset of illicit trade and intellectual property right infringements that is separate from contraband trade, illicit trade in controlled goods and trade in stolen goods. Counterfeiting can occur in the area of money and official documents, services and physical goods. It can be of a deceptive or non-deceptive nature. In deceptive counterfeits, the consumer is unaware that the item is, in fact, a counterfeit, whereas with non-deceptive counterfeits, the consumer is fully aware of the illicit nature of the product. The counterfeit medicine examples mentioned in the introduction section of this chapter are deceptive counterfeits, while the purchase of knock-offs of designer purses are examples of non-deceptive counterfeiting. Phillips' (2005) book on counterfeiting includes a discussion of "brand bandits" and "counterfeit alley" examples of non-deceptive counterfeits. While both deceptive and non-deceptive counterfeits are important, for the purpose of supply chain quality management research, our focus is in the area of deceptive counterfeiting as it impacts the licit supply chains of manufacturers, distributors, wholesalers, retailers, and end-users of products.

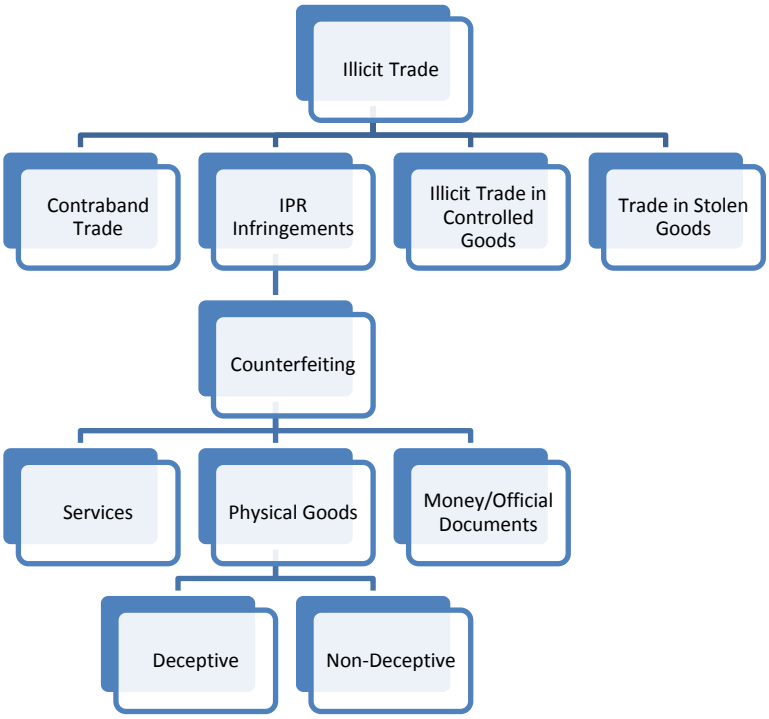

FIGURE 2.1 – CLASSIFICATION OF COUNTERFEITING AND RELATED TERMS
SOURCE: STAAKE ET AL., 2009

The other notable contribution of Staake et al.'s (2009) work is that it identifies four primary research focus areas related to counterfeiting: (1) general descriptions of counterfeiting, (2) impact analyses, which investigate the consequences of counterfeits, (3) supply-side investigations, which address production settings, tactics and motives of illicit actors and how their products enter the legitimate supply chain, and (4) demand-side investigations, which focus on consumer behavior and attitudes related to counterfeit goods. Staake et al. (2009) concede that the amount of academic research related to supply-side investigations is limited, acknowledging that very few publications are dedicated to these issues, despite the importance of understanding how this side operates, and how licit companies can fight illicit producers. This essay serves to motivate a research agenda focusing on counterfeits in supply chains.

Numerous definitions for counterfeits can be found across industries and government agencies (GAO, 2010). Efforts are being made to develop such standards in industries and government agencies, both at the national and international level. For example, SAE International (2009) has developed AS5553, *Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition*. In this standard, two definitions are provided. A "Suspect Part" is defined as a part where there exists, through inspection, testing or other information, evidence that it may have been misrepresented by the supplier or manufacturer. A "Counterfeit Part" has a more stringent definition stating that the part is a suspect part that is ***also*** a copy or substitute without legal right or authority to do so or one whose material, performance, or characteristics are knowingly misrepresented by a supplier in the supply chain. This more stringent definition identifies the deceptive element of counterfeit as well as the intellectual property rights element of these items.

Other examples of definitions were found in the Aerospace Industries Association's (AIA) 2011 report on counterfeit parts and the World Health Organization's (WHO, 2008; WHO, 2012) task force on counterfeit pharmaceuticals. The AIA defined a counterfeit as "product produced or altered to resemble a product without authority or right to do so, with the intent to mislead or defraud by presenting the imitation as original or genuine" (AIA, 2011). The WHO defined a counterfeit medicine as "one which is deliberately and fraudulently mislabeled with respect to identity and/or source. Counterfeiting can apply to both branded and generic products and counterfeit products may include products with the correct ingredients or with the wrong ingredients,

without active ingredients, with insufficient active ingredients or with fake packaging" (WHO, 2012).

These various definitions of counterfeits in industries demonstrated to us that there exists a need for a parsimonious and relevant definition of product counterfeits that could be used in a broad variety of supply chain management research applications. To develop this general definition, we conducted an extensive literature review of numerous academic, government and industry publications. Table 2.1 is the summary of the definitions we found in our research. From the research conducted by Staake et al. (2009) and this list of definitions, a set of characteristics for our definition of deceptive product counterfeits in legitimate supply chains emerged.

Authors	Year	Definition
Staake, Theisse and Fleisch	2012	Counterfeit trademark goods: any goods, including packaging, bearing without authorization, a trademark that is identical to the trademark validly registered in respect of such goods or that cannot be distinguished in its essential aspects from such a trademark, which thereby infringes the rights of the owner of the trademark in question under the law of the country of importation (WTO, 1994 TRIPS Agreement).
Mavlanova and Benbunan-Fich	2010	Product counterfeiting is the unauthorized manufacturing or commercialization of goods whose characteristics are protected by trademarks, patents or copyrights.
Sood, Das and Pecht	2011	Counterfeit electronic part is one whose identity (e.g., manufacturer, date code, lot code) has been deliberately misrepresented.
Aerospace Industries Association	2011	Counterfeit parts are defined as a product produced or altered to resemble a product without authority or right to do so, with the intent to mislead or defraud by presenting the imitation as original or genuine.
Yang and Fryxell	2009	Counterfeiting-- the unauthorised imitative production of products and/or services that are protected by owners' intellectual property rights (IPR) in the

		pursuit of profit.
Chaudhry, Zimmermann Peters and Cordell	2009	Uses Cordell et al.'s (1996) definition - product counterfeiting involves any unauthorized manufacturing of goods whose special characteristics are protected as intellectual property rights, or trademarks, patents and copyrights.
Staake and Fleisch	2008	Counterfeiting denotes the unauthorized reproduction of goods, services, or documents in relation which the state confers upon legal entities a statutory monopoly to prevent their exploitation by others. Deceptive counterfeiting -- refers to cases where a person or organization purchases counterfeit goods in the belief they are buying genuine articles. Non-deceptive counterfeiting shall refer to cases where a person or an organization purchases counterfeit goods knowing of their counterfeit nature.
Yang, Sonmez and Bosworth	2004	Counterfeiting, which means "to imitate exactly something valuable or important," such as counterfeited money, with intent to defraud or deceive.
Cordell et al.	1996	Any unauthorized manufacturing of goods whose special characteristics are protected as intellectual property rights (trademarks, patents, and copyrights)
Shultz and Saporito	1996	Counterfeiting is the unauthorized production of goods that are legally protected by trademarks, copyrights or patents.

TABLE 2.1 – DEFINITIONS OF PRODUCT COUNTERFEITING IN EXTANT LITERATURE

The underlined terms in Table 2.1 highlight the common characteristics of counterfeit definitions that are applicable to our conceptualization of deceptive product counterfeits as related to the field of supply chain management. In these definitions, three elements emerged which constitute the core of our definition of deceptive product counterfeit: 1.) unauthorized manufacture or production of a tangible good, 2.) violating/infringing on another's intellectual property rights, and 3.) misrepresenting the nature of the product in order to deceive the buyer into believing that the counterfeit is an

authentic item. Figure 2.2 depicts these three elements, integrating them into a formal definition:

> ***Deceptive Product Counterfeiting*** *is the unauthorized manufacture and/or distribution and sale of goods, misrepresenting these goods as genuine articles that are protected as the specific intellectual property of an individual and/or organization.*

This definition of deceptive product counterfeiting applies to the action of committing the counterfeiting. The outcome of this act is the good that constitutes a deceptive product counterfeit, specifically defined:

> ***Deceptive Product Counterfeit*** *is any product that has been manufactured and/or distributed and sold by an entity that is not authorized by the intellectual property rights' owner and is intentionally misrepresented by the seller as a genuine article.*

Three Dimensions of Deceptive Product Counterfeiting

To ensure a comprehensive and parsimonious conceptualization of this construct, we will break this definition into parts and discuss them individually. Figure 2.2 illustrates the three dimensions of deceptive product counterfeits explained in detail below.

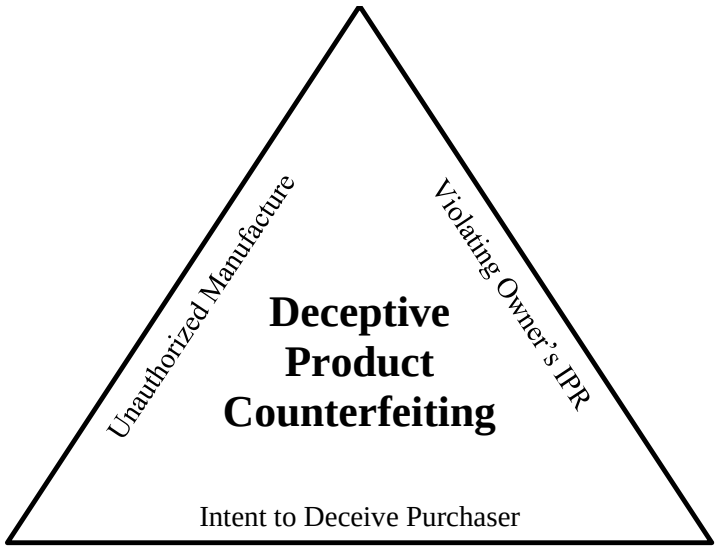

FIGURE 2.2 – THREE DIMENSIONS OF DECEPTIVE PRODUCT COUNTERFEITING

Unauthorized Manufacture

The first dimension of deceptive product counterfeiting is the unauthorized manufacture or distribution and sale aspect of the act. In this context, unauthorized manufacturing or distribution refers to either producing or distributing a good without the consent of the intellectual property owner. This includes a variety of types of counterfeiting activities, such as reversed engineered "knock-offs," refurbished items and inferior scrap items sold as new items, and factory overruns. Factory overruns occur when a contractor with a license from an intellectual property owner produces goods in excess of the limit of the licensing or distribution contract granted by the intellectual property holder (Staake and Fleisch, 2009).

While other researchers (Staake and Fleisch, 2009) do not include factory overruns and seconds sold on the gray market in their definitions of counterfeits, we

chose to incorporate them because practitioners and industry groups perceive these as issues of counterfeiting and include them in their counts of counterfeit goods. Staake and Fleisch (2009) are correct in that this is a breach of contract more so than intellectual property infringement, but the effect on a firm's profits, loss of sales, and branding impact are essentially the same. As such, we chose to include these for the sake of comprehensiveness. In a similar vein, we included positioning refurbished items as new as part of counterfeiting because industry and government entities incorporate this into their working definitions of counterfeiting (SASC, 2012; SAE Aerospace, 2009).

Since supply chains are complex and involve many stages where manufacturing, sourcing, assembly, distribution and disposal occur, we incorporate all of these stages into our definition because counterfeits could enter the supply chain at any point in these activities. The situation becomes even more complex when the supply chain also includes product recovery nodes (see Fleischmann, Krikke, Dekker and Flapper, 2000, for a description of product recovery activities in supply chains), which allow for additional source nodes of materials to be converted into counterfeit items.

Violating Owner's Intellectual Property Rights (IPR)

Deceptive product counterfeits can enter into a licit supply chain through multiple mechanisms, all of which amount to an IPR violation of some form. Any legal entity (e.g. individual, corporation or an industry standards group) can hold intellectual property rights, including patents, trademarks and copyrights. Intellectual property refers to the "creations of the mind, such as inventions; literary and artistic works; designs; and symbols, names and images used in commerce" (World Intellectual Property

Organization, 2015). Intellectual property is often shared with supply chain partners under license in subcontract arrangements.

A subcontractor can engage in "third shift" manufacturing of factory overruns, whereby the subcontractor fills the order for the intellectual property owner using the day and swing shift operations in a factory and then "sells" the production capacity of a third shift of workers to a counterfeiter, or the subcontractor actually becomes a counterfeiter, selling the additional units of production "out the back door" or "off the back of a truck," to use two common euphemisms for counterfeit operations (Parloff, 2006). This practice has impacted brand-name companies like New Balance shoes (Parloff, 2006). Counterfeits are also produced by subcontractors after their licensing agreements with intellectual property owners are terminated or product lines are discontinued (Parloff, 2006).

Reverse engineering of components is another source of counterfeits. When addressing reverse engineering as a source of counterfeits, it is important to distinguish it from reverse engineering for the purposes of making a competitive product (Minagawa, Trott and Hoecht, 2007), which is part of how other firms learn and compete in markets. Producing an item through reverse engineering, coupled with claiming it is the genuine article protected as intellectual property, results in a counterfeit deceptive product.

Another entry of counterfeits into supply chains occurs in scrap, disposal and reclamation activities. Inferior goods are disposed of by intellectual property owners or upstream and downstream participants in the supply chain and then repackaged by counterfeiters and sold as the original quality item. In all of these examples, counterfeits

enter supply chains posing as genuine articles violating an owner's intellectual property rights.

Intent To Deceive

The final dimension of deceptive product counterfeiting is that the counterfeiter intends to defraud the purchaser of the counterfeit product into believing that the goods are the genuine article that is someone else's intellectual property. This intent to deceive is what differentiates a deceptive product counterfeit from a non-deceptive counterfeit, the two categories defined by Staake et al. (2009).

Deceptive product counterfeiting exists when the buyer is unaware that the product is a counterfeit good, while a non-deceptive counterfeiting situation occurs where the buyer is aware that the item being procured is a counterfeit product. Non-deceptive counterfeit situations are often the case in the area of luxury brand name goods, such as Rolex watches, Coach and Burberry leather goods, and iPhones. There is a substantial literature stream in the marketing discipline that examines consumer attitudes regarding non-deceptive counterfeit goods (e.g. Grossman and Shapiro, 1988a and b; Wee, Ta, and Cheok, 1995; Tom, Garibaldi, Zeng and Pilcher, 1998). This chapter focuses on deceptive product counterfeiting, approaching the topic from a supply chain management perspective; therefore, we differentiate deceptive product counterfeits from other types of parts quality constructs.

Deceptive Product Counterfeit – Construct Differentiation

As illustrated in Figure 2.3, nonconforming, and defective products are concepts related to deceptive product counterfeits, but that are distinctly different constructs. In

fact, these items can potentially become deceptive product counterfeits if an entity attempts to hide the nature of the defect and pass the article off as a genuine, functional, first-quality part protected as another person's or organization's intellectual property. Because these concepts are on the periphery of our research and related to our subject of deceptive product counterfeits, it is necessary to isolate our subject area from these related terms.

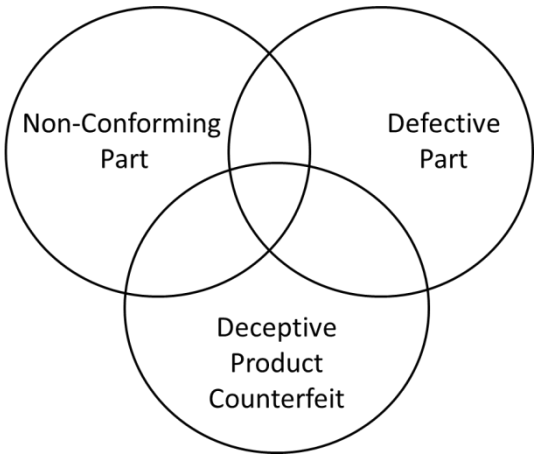

FIGURE 2.3 – DECEPTIVE COUNTERFEIT CONSTRUCT DIFFERENTIATION

The concept of a nonconforming product is based in quality management. Such a product is one that fails to operate to the expected level of performance as documented in the product's technical specifications and requirements. The ISO 9000 standards focus on controlling and eliminating such non-conformities. APICS addresses nonconformance by defining nonconforming materials as "any raw material, part, component, or product with one or more characteristics that depart from the specifications, drawing, or other approved product description" (APICS, 2015). The American Society for Quality has a similar definition for nonconformity, stating that is "the nonfulfillment of a specified requirement" (ASQ, 2015). Another term, often used synonymously, yet erroneously,

with nonconforming product is defective product. This concept is actually a legal term that constitutes the very core of the area of product liability law. A defective product is defined as a product that has the tendency or propensity to do harm to its ordinary user, meaning an item manufactured to the expected standards and conforms to specifications may still be a defective product in the legal sense if its design has the propensity to cause physical harm to a normal user.

2.4 Theoretical Lenses for Exploring Counterfeiting Within Supply Chains

The theoretical bases we use to explain why these antecedents are positively related to vulnerability to counterfeiting are Normal Accident Theory (NAT), Signaling Theory, Deception Theory and Crime Prevention Theory. We then apply Signaling Theory, Deception Theory and High Reliability Theory (HRT) to explain why the Six Ts of Supply Chain Quality Management (Roth et al., 2008) can be used to moderate the relationship between vulnerability to counterfeiting and the performance impacts associated with it.

Normal Accident Theory

Normal Accident Theory, first developed by Perrow (1984) as part of analyzing the Three Mile Island disaster, then later applied to investigations like the space shuttle Columbia disaster, states that accidents are inevitable and are a normal occurrence in systems that are tightly coupled and complex in terms of the interactions among elements of the systems. This systems theory has been applied to a variety of academic and industry sectors such as healthcare (Tamuz and Harrison, 2006) and petrochemical

production (Wolf, 2001; Wolf and Sampson, 2007). The two dimensions at the core of Normal Accident Theory are complexity of interactions and coupling. Complexity of interactions refers to the degree of interactions that are unanticipated, unfamiliar events, particularly when these events are hard to visualize and difficult to analyze in terms of the firm being able to immediately comprehend their impact on processes (Perrow, 1984). Tight coupling refers to a large interaction and dependence among processes in the system.

In the discipline of supply chain management, Normal Accident Theory has been used to examine supply chain security, disruptions and adverse events (Speier, Whipple, Closs and Voss, 2011; Skilton and Robinson, 2009). Speier et al. (2011) propose that a firm experiences complex supply chain interactions when its processes involve unfamiliar events, specifically when these events are not directly visible and their impact on processes cannot be readily and completely comprehended by the firm. They further posit that when supply chains are tightly coupled, lacking buffering either in the form of suppliers, production centers or personnel, they have less potential to recover from an incident than those supply chains with some slack resources and slack designed into them. In their application of NAT to supply chain disruptions and security, Speier et al. (2011) recognize that some accidents are unintentional and some intentional. This is an important consideration when exploring the issue of counterfeiting in supply chains, which can be an intentional or unintentional accident.

Outside parties can target a vulnerable supply chain at multiple points. They could target the firm itself, the firm's upstream suppliers or the firm's downstream customers as

the victims of counterfeiting. If the upstream supplier is targeted and that firm uses a counterfeit part in a subcomponent, the supplier will have unintentionally allowed a counterfeit part to infiltrate the focal firm's supply chain. In the case of "third-shift" production of counterfeits, the supplier becomes an intentional counterfeiter of products, selling the focal firm's products to customers without paying appropriate royalties or fees to the intellectual property owners. While Normal Accident Theory can be used to explain how the structure of supply chains can contribute to accidents or, in our case, the infiltration of counterfeits, High Reliability Theory can provide insights into how to construct processes to be highly reliable, even in high-risk situations.

High Reliability Theory

While NAT assumes that some accidents are inevitable events, High Reliability Theory (HRT) posits that most accidents and disruptions are preventable, stating that, even in high risk scenarios (e.g. nuclear power plants, aircraft carrier operations), organizations can develop strategies to reduce problems and encourage organizational reliability (Weick, 1987). To cultivate a high reliability organization, the firm needs to focus on the potential for failure and foster a culture of mindfulness that enables it to develop cognitive processes to detect the occurrence of problems and direct attention to take the actions necessary to address these problems before they escalate out of control (Weick, Sutcliffe and Obstfeld, 2008). High reliability is related to quality processes. In their discussion of high reliability organizations, Weick and colleagues (2008, p. 60) propose "if high reliability organizing is understood in part as a strategy to deploy attention, quality practices could be viewed as devices to direct and channel that

attention." Our view is that employing a strategy of supply chain quality management can improve the ability of a firm to detect and resolve issues of counterfeiting before they escalate out of control. Employing quality management across the supply chain will allow even tightly coupled supply chains with complex interactions to prevent and detect counterfeiting issues.

Roth and colleagues (2008) developed the Six Ts framework for supply chain quality management and improvement for the purpose of improving the safety and security of food supply chains, as a result of the growing complexity of supply chains due to globalization. According to their framework, implementing traceability, transparency, trust and training programs, while considering time and testability factors, can improve the quality management of supply chains (Roth et al., 2008). Following the logic of Weick and colleagues (2008), it is reasonable to expect that employing quality management across the supply chain can focus the attention of managers on variances in quality that would be indicative of counterfeit problems, such as identifying illicit distribution channels, deceptive packaging and non-conformities in product information and labeling.

Signaling Theory

As we examine the entry of counterfeits into supply chains, the primary point may occur during the purchasing decision. As such, Signaling Theory, (Spence, 1974), provides valuable insight into how training might prove beneficial in preventing counterfeits. In situations of information asymmetry, agents can convey information, either honest or dishonest, that causes a principal to alter his/her behavior (Spence, 1974).

This concept has been applied in consumer counterfeit situations by Mavlanova and Benbunan-Fich (2010), where they examined consumers' abilities to process trust and deception signals in e-commerce purchasing situations involving potential counterfeits. More recently, Stevenson and Busby's (2015) qualitative research expands upon the understanding of the signals used in counterfeits, offering insights into how counterfeiters utilize signals by obscuring information, transmitting signals, acting upon demand signals from the markets, and exploiting signals. They go on to offer potential strategies for addressing the counterfeit threat to licit supply chains.

Crime Prevention Theory

In their work on supply chain security, Speier, Whipple, Closs and Voss (2011) used a combination of NAT and HRT with situational crime prevention theory and disaster management processes to posit that organizations that are able to prevent, detect, respond and recover from security incidents can create resiliency and ensure the sustainability of their supply chains. They argue that intentional acts against supply chains are a result of an opportune target and location, lack of sufficient guardianship and an offender willing to seize the opportunity to attack a vulnerable supply chain.

While being able to detect and eliminate counterfeits as they enter the supply chain is important, it is equally important to attempt to prevent the infiltration from occurring in the first place. One way to achieve prevention is to understand the ways in which a counterfeiter could operate to sell deceptive counterfeits across a supply chain. Deception Theory serves as a lens by which firms can understand how a counterfeiter might attempt to fool elements of a supply chain into purchasing deceptive counterfeits.

Deception Theory

Deception Theory explains how an entity uses a combination of simulative and dissimulative tactics to deceive a target into believing a falsehood (Bowyer, 1982; Whaley, 1982; Bell and Whaley, 1991; Johnson, Grazioli and Jamal, 1993; Santos and Johnson, 2004). This theory has been applied with signaling theory to understand product counterfeiting in consumer e-commerce purchasing by Mavlanova and Benbunan-Fich (2010). Simulative tactics, including mimicking, inventing a false reality, and decoying, are used in an attempt to attract a victim through showing false information to lure them into believing a falsehood, while dissimulative tactics, such as masking, repackaging and dazzling, are attempts to make the false goods blend into the normal environment, thus hiding their true nature (Santos and Johnson, 2004). In the case of deceptive product counterfeiting, masking and repackaging are commonly used simulative tactics. In the electronics industry, there are documented cases where older circuits have their parts and serial numbers removed and newer numbers marked on them in an attempt to make the older materials seem newer. Using deception theory to help understand the ways in which counterfeiters may accomplish their deceit can be helpful in developing tailored strategies to prevent and detect the occurrence of counterfeiting in supply chains.

There is very limited research on how counterfeiters accomplish their deceit due to the illicit nature of counterfeiting (Staake, Theisse and Fleisch, 2008). Minagawa and colleagues (2007) conducted case-based research on counterfeiting, imitation and reverse engineering from a Chinese perspective, using information from three key informants to provide insights into why firms engage in non-consensual acquisition of technology.

Staake and colleagues (2012) used cluster analysis of industry experts' assessments of counterfeited items to derive business strategies used by counterfeiters, identifying five strategic groups: disaggregators, imitators, fraudsters, desperados and smugglers. While these two studies serve as valuable theory-building opportunities, we believe that the incorporation of deception theory in this research area will enable more theoretical clarity by providing insights as to "how" counterfeiters conduct their activities, thus enabling supply chain managers to select and implement tailored anti-counterfeiting strategies.

2.5 A Product Counterfeiting Research Framework For Supply Chain Management

Figure 2.4 depicts our conceptual framework for exploring product counterfeits from a supply chain perspective. At the core of this model is the construct we call "Vulnerability to Product Counterfeits," defined here as susceptibility, or a predisposition, for having counterfeits enter the firm's supply and demand chain because of a combination of product attributes and supply chain practices, processes and characteristics. Our conceptualization of vulnerability to product counterfeits builds on existing work on supply chain disruption and supply chain vulnerability, refining and applying it specifically to the case of counterfeits. We propose that a supply chain quality management approach can be used to mitigate the potential impacts of counterfeits in supply chains.

In supply chain disruption literature, the construct of supply chain vulnerability is viewed as a "function of certain supply chain characteristics" (Wagner and Bode, 2006, p. 304), a vulnerability that is based on susceptibility to loss due to practices or

conditions within an organizational structure (Barnes and Oloruntoba, 2005). In their work on relating vulnerability to risk impacts, Wagner and Bode (2006) view supply chain vulnerability as a driver of detrimental results to the demand and supply side of caused by supply chain disruptions. Later work by these authors articulates the concept more precisely, stating there are characteristics of supply chains that are antecedents of the chain's overall vulnerability to disruption, characteristics that affect both the likelihood of the occurrence of disruptions and the resulting magnitude of the impact of these disruptions to the operation of the supply chain (Wagner and Bode, 2009).

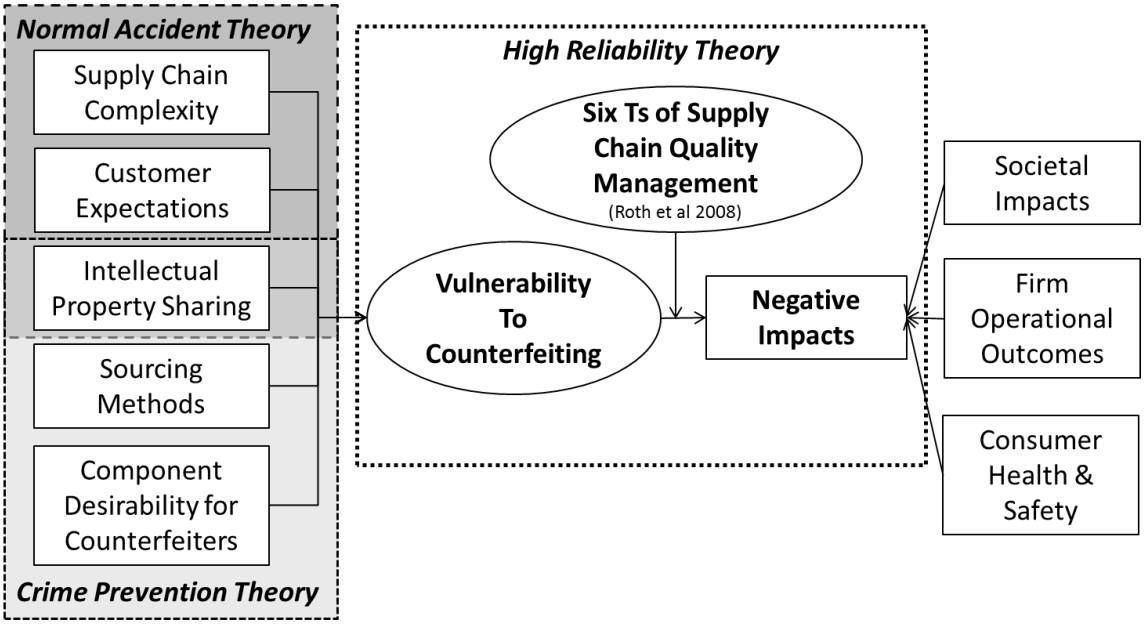

FIGURE 2.4 – THEORETICALLY-DRIVEN CONCEPTUAL FRAMEWORK FOR VULNERABILITY TO PRODUCT COUNTERFEITING AND MITIGATION IT'S IMPACT USING SUPPLY CHAIN QUALITY MANAGEMENT

Antecedents of Vulnerability to Product Counterfeits

There are five antecedents of Vulnerability to Counterfeiting identified in our model: 1.) upstream supply chain complexity, 2.) customer expectations, 3.) intellectual

property sharing, 4.) sourcing factors, and 5.) component desirability. We posit that each of these elements increases a firm's vulnerability to product counterfeits entering the supply chain. There are two theoretical foundations from which we derive our antecedents. Normal Accident Theory's constructs of complexity and coupling can be applied to explain how supply chain complexity, customer expectations and intellectual property sharing create the types of supply chain processes that make it more likely for the "intentional accident" of counterfeiting to occur. Similarly, Crime Prevention Theory's concepts of targets, lack of guardians, and willing offender explain how the antecedents of component desirability and intellectual property sharing can create additional vulnerability to counterfeiting.

Upstream Supply Chain Complexity

Upstream supply chain complexity is comprised of both detail and dynamic complexity (Bozarth, Warsing, Flynn and Flynn, 2009) within the focal firm's upstream supply base. Detail complexity refers to the number of components or elements that comprise a system, while dynamic complexity deals with the degree of resultant unpredictability in the system's response to a given set of inputs (Bozarth et al., 2009). Bozarth et al. (2009) further conceptualize the number of suppliers, long supplier lead times, and globalization of the supply base as the sources of increased upstream supply chain complexity, with the number of suppliers capturing detail complexity and lead times and globalization capturing detail and dynamic complexity in the upstream supply base (Bozarth et al., 2009).

As Bozarth and colleagues (2009) explain, the number of suppliers increases detail and dynamic complexity by increasing the required number of information flows, physical goods flows, and relationships that need to be managed. Similarly, they posit that long and unreliable lead times capture both detail and dynamic complexity by requiring the focal manufacturing plant to adapt their planning processes to include longer planning horizons and increased levels of detail (Bozarth, Warsing, Flynn and Flynn, 2009). The final dimension they include is globalization, which they base on the work of Nellore, Chanaron and Soderquist (2001), arguing that it increases dynamic complexity due to the increase in cultural differences, currency exchange rate fluctuations, and longer lead-times, all of which can shift the purchasing firm from strictly focusing on price to including other factors in the decision process for selection of suppliers (Bozarth et al., 2009).

We refine their conceptualization by adding three dimensions to their conceptualization of this complexity: 1.) operations in emerging markets, 2.) the number of upstream outsourced production activities, and 3.) the number of transportation methods used in the delivery of goods from upstream suppliers. We add these dimensions to capture additional detail and dynamic complexity within the upstream supply base that we believe is related to vulnerability to product counterfeits.

We posit that operations in emerging markets add to dynamic complexity in addition to the elements captured in the globalization dimension. The globalization dimension applies to operations in both established and emerging markets, but there are specific factors related to operations in emerging markets that increase dynamic

complexity. In work evaluating counterfeit production in China, Chaudhry, Cordell and Zimmerman (2005) and Chaudhry (2006) identify a lack of protection of intellectual property rights, a culture where IPR violations are not morally wrong, organized crime, and local willingness to purchase counterfeits as explanations for China's high level of product counterfeiting. Similarly, other emerging markets have considerable diversity in the levels of intellectual property protection, local corruption and organized crime (Chaudhry et al., 2005; Roth et al., 2008). As such, the factors that a firm must consider while conducting operations in these markets increase, thereby increasing the dynamic complexity of the management of the upstream supply chain.

While operations in emerging markets add to dynamic complexity, the number of upstream outsourced production activities adds to both the dynamic and detail complexity in the upstream supply chain. When production activities are outsourced, the focal firm's products move through the supply chain in various states of completion. There is an increase in the amount of information needed regarding the amount of work in process at each location and in-transit information between production activities. By decentralizing production, the amount of coordination between the focal firm and its outsourced production providers is added to the amount of coordination that was required in the supply chain without outsourcing of production.

In addition to the supply and production nodes within a supply chain, there are also transportation nodes and networks, which can vary from very simple to very complex. Simple transportation activities include, for example, where the focal firm that has its own fleet of vehicles and only operates in a small local area. More complex

transportation networks involve multiple modes of transportation (e.g. automotive, rail, air, and ship), multiple providers/carriers, and a greater span of distances in the network (e.g. interstate, trans-continental, or trans-oceanic), as well as customs and inspections processes for shipments between countries. Integrating information from multiple modes, providers, exchanges and inspection points adds dynamic and detail complexity to supply chain management.

As mentioned in our review of NAT, the amount of complexity in a system can increase the likeliness of accidents occurring in a supply chain. Following the analysis of Speier and colleagues (2011), criminal activities directed at a supply chain can be viewed as a type of accident; therefore, deceptive product counterfeiting would be expected to occur in more complex supply chains, where the odds of the Roth and colleagues' (2008) Six Ts elements being consistently present are very low. Following this logic, we view supply chain complexity as an antecedent to vulnerability to counterfeiting since complex supply chains have a large number of entry points (locations) and a large number of items of supply (targets) that could potentially attract counterfeiters (offenders).

Challenging Customer Expectations

Customers seek parts, particularly replacement items, in the right quantity, the with right quality, and in the right timeline. There is pressure in business-to-business markets to make products better, faster and cheaper. But this kind of demanding customer relationship can unintentionally add to the potential for counterfeits to find their way into the licit supply chain. Suppliers want to be customer-focused and responsive to the expectations of their customers, meaning they may go the extra mile to satisfy these

requirements. When parts or products are needed but not available at the focal firm, we posit that the firm will look to other suppliers or entities in the market to obtain what they need to fulfill customer expectations. If the lead time for an item is not going to meet required delivery dates, the firm may seek alternative sources for the parts, such as trying to find the item from a source other than a currently qualified vendor (i.e. gray market or aftermarket distributors). While the distributor may genuinely believe he is providing the focal firm a legitimate good, it could be a counterfeit part.

Demanding customers can inadvertently create situational opportunities for counterfeits to enter their supply chains. Based on the Normal Accident Theory, external demands from customers can force the focal firm to operate outside of its normal operating environment, increasing the dynamic complexity of its purchasing environment, by "thinking outside the box" in order to satisfy and retain customers, creating the conditions or "location" for a counterfeiter to perpetuate his fraud.

While customer demands are one factor that can create the opportunity for a counterfeiter's illicit activities, there is another factor that is equally or even more likely to create vulnerability to counterfeiting. This situation occurs when production activities are outsourced or shifted to new production centers and intellectual property is shared with these locations.

Intellectual Property Sharing

Intellectual property sharing occurs when the focal firm provides or authorizes use of its intellectual property right protected documents, equipment, tooling, and/or processes with upstream suppliers, distributors and/or vendors. As mentioned by Berman

(2008), Parloff (2006) and Norman (2001), sharing intellectual property can encourage the authorized user to misuse the property and engage in third-shift production and counterfeiting activities. This problem is compounded by operations in emerging markets, such as China, where the level of IPR protection enforcement by the government is considered low and organized crime is prevalent (Chaudhry, 2006; Berman, 2008). Considerable research has been conducted in the area of IPR protection in outsourcing situations, most in the marketing discipline (Chaudhry et al., 2009, Kumar and Ellingson, 2007; Shultz and Saporito, 1996; Chaudhry, Cordell and Zimmerman, 2005). There is also substantial published research in international business and legal reviews. Crime Prevention Theory suggests that a willing offender, opportune target and a lack of sufficient guardianship are all potentially present in situations where intellectual property is shared outside of its owner's direct management, particularly in cases where legal recourse does not act to support guardianship of the property rights.

Sourcing Factors

We define sourcing factors as how the focal firm conducts its procurement and sourcing activities. This antecedent focuses on how the firm orchestrates its purchasing of supplies and materials for its operations. The aspects of sourcing that are posited to increase vulnerability to counterfeits include a lack of experience, training and time on the part of buyers to enable them to understand and detect counterfeits, as well as the use of gray markets, independent and aftermarket brokers, (Berman, 2008) and independent distributors (Livingston, 2013). Also included as a sourcing factor is the use of internet auctions and suppliers of parts. The purchasing and supply chain management function of

a firm serves as the guardian of the supply chain, guarding against the purchase of counterfeit items. In order to serve as an effective guardian, the purchasing team should be trained to detect indications of counterfeits during the purchasing decision process, including understanding whether the materials, components or sub-assemblies they purchase are potential targets for counterfeiters to exploit. For example, the electronic sub-component sector is a ripe target for counterfeiters as a result of the e-waste stream and the rapidly changing part specifications.

Impacts of Counterfeits

We characterize the impact of counterfeits as the negative outcomes associated with the incursion of deceptive counterfeits into a legitimate supply chain. As such, we view them as generally negative consequences related to the firm's operating performance, the consumer's health and safety, and the country's fiscal well-being. Since we are focused on supply chains, we will present a more detailed review of the literature in the area of firms after providing a brief summary of information on the consumer and societal impacts.

Before we discuss the impacts, it is important to acknowledge that other authors have also articulated that there are positive effects associated with counterfeiting, such as increasing competition in the market through technology transfer to emerging markets (McDonald and Roberts, 1994). IPR infringements, while not specifically limited to counterfeits, are also noted as having consumer benefits (Feinberg and Rousslang, 1990) and satisfy market demands, a positive outcome from an economic perspective (McDonald and Roberts, 1994). The literature also reveals that from a marketing

perspective, companies may experience an increase in brand awareness (Barnett, 2005; Yao, 2005). While these positive outcomes are interesting to note, the literature indicates that the effects of counterfeits on the legitimate firm's supply chain are primarily negative, so we focus on the impacts from that perspective.

Consumer Health and Safety

From a consumer perspective, there are two general impacts of deceptive counterfeiting. First, the consumer is the victim of a fraud, where the counterfeiter misleads the customer into believing that he or she is procuring a genuine item when, in fact, it is an unauthorized reproduction of an IPR-protected legitimate item. Secondly, there are potential health and safety consequences associated with procuring counterfeit items. Tim Phillips' (2005) book *Knock Off: The Deadly Trade in Counterfeit Goods* analyzes how the global counterfeit trade is related to organized crime, corruption, violence and even death. One area in particular that is a health and safety concern for consumers, as mentioned in our introduction, is pharmaceuticals. Cockburn, Newton, Agyarko, Akunyili, and White (2009) provide a detailed discussion of the magnitude of the problem in the pharmaceutical industry, citing estimates that 10% of the world's supply is counterfeit and that this results in unnecessary morbidity and mortality.

Societal Impacts

While consumer impacts are generally associated with the use of deceptive counterfeit goods, country-level impacts are generally conceptualized in terms of the loss of tax and tariff revenues associated with counterfeits, both deceptive and non-deceptive, in this situation (Chaudhry, Zimmerman, Peters and Cordell, 2009). While there are

concerns about how the estimates of lost revenue due to counterfeiting activities are generated (GAO, 2010; SASC, 2012), national and local agencies have posted estimates. For example, according to a 2004 report, the New York City comptroller's office estimated that counterfeit trade in New York City was $23 billion, resulting in $1 billion in lost tax revenues (NYC Comptroller, 2004).

Firm Operational Impacts

While the consumer and governmental impacts are important, our focus is on the impact to the firm. When a firm's products are counterfeited, there is a potential for loss of brand equity (Wilke and Zaichkowsky, 1999), as well as loss of demand and sales (Green and Smith, 2002) since counterfeit items are generally sold below the price of the genuine product. This assumes that the purchaser would have paid the firm's price for the legitimate item, were the counterfeit good not available, an assumption that is not necessarily true for non-deceptive counterfeits become some would not purchase the genuine item because of the cost (Chaudhry et al., 2008). Different types of goods have different price elasticity of demand, but, in the case of deceptive counterfeits, the purchaser expects to pay for the genuine article, so they want the real thing and are willing to pay the price for it.

Further, when some another entity is filling a demand that would normally be satisfied by the firm, there is a loss of demand to the counterfeit market. Knowing the actual demand losses is difficult since gathering data on illegal activities is difficult, we assert that obtaining the firm's perceived loss of demand from a subject matter expert might provide insights in the absence of direct data on losses.

Interestingly, studies have evaluated the potential impact of loss of brand image and equity, finding that consumers' perceptions of the original product's brand image was not affected by the proliferation of counterfeits (Nia and Zaichkowsky, 2000); however, this study examined luxury brands, which are generally non-deceptive counterfeits, so it is difficult to apply these conclusions to deceptive counterfeit situations. While brand image may not be affected by counterfeits, profits are generally expected to be. There are no studies as yet that document the perceived loss of demand from the firm's perspective, but the resultant loss of profits associated with lost sales is a concern that is often raised in media, interest group and practitioner literature.

Another impact to the firm that is cited in literature is an increase in costs as a result of having to implement anti-counterfeiting measures. There are numerous countermeasures available and firms should tailor them based on their specific counterfeit risks and potential ways that counterfeiters might attack their supply chain. While these increase costs, they are recommended to be perceived as an investment because, if effective, these intellectual property protection measures should prevent counterfeit proliferation and help the firm prevent loss of market share in the short-term, mid-term and long-term (Fuchs and Zhao, 2010). Intellectual property protection programs may be costly, but they are necessary in the battle against counterfeiting. In addition, firms face the costs of remediating counterfeits in supply chains. These can be extensive, especially when dealing with counterfeits that have infiltrated complex or capital intensive investment items or those items that have consumer safety concerns.

With so many potential sources of vulnerability to counterfeits and such substantial potential impacts, it begs the question of what can be done to "counter" the potential for counterfeits entering the supply chain. Academic research has dedicated a considerable amount of effort into understanding how firms deal with counterfeiting and have provided a plethora of options to consider regarding how to deal with counterfeiting.

Strategies to Mitigate Counterfeiting – A Supply Chain Quality Management Perspective

There have been many articles offering strategies for addressing the counterfeit problem, but they are not organized in a manner to easily facilitate an examination using a supply chain management lens. We will provide a general overview of the strategy literature and then apply Roth et al. (2008) Six Ts of Supply Chain Quality Management as a structure for developing a typology for organizing counterfeit mitigation strategies. This framework is intended to enable managers and researchers to approach the issue of quality in supply chains at the strategic level. As mentioned in our discussion of theoretical lenses, the holistic nature of the Six Ts (Roth et al., 2008) enables a firm to improve mindfulness and detect and prevent quality issues proactively, an approach consistent with the mindfulness objectives in the High Reliability Theory (Weick, 1987).

Strategies for Addressing Counterfeiting

In their literature review on counterfeiting, Staake et al. (2009) identify 24 articles that offer strategies and recommendations for addressing counterfeiting, some of which offer general strategies, while others are more specific, recommending strategies tailored to specific countries (Chaudhry et al., 2008). This is not surprising, given that a large

percentage of the U.S. and E.U. seized counterfeits appear to originate in China (CBP, 2012; EU, 2012) and China's recorded of respecting intellectual property rights has been assessed as poor by the Office of the U.S. Trade Representative (2012), putting the country at the top of the Priority Watch List.

Early strategy articles address how firms can respond to the issue of illicit actors obtaining firm's confidential information, allowing them to generate counterfeits (Harvey and Ronkainen, 1985; Harvey, 1987; Harvey, 1988), discussing how firms can establish relationships with dealers and distributors to collaborate on combating counterfeiting (Olsen and Granzin, 1992; Olsen and Granzin, 1993). Some articles take a broad approach, offering general strategies to managers of affected firms. For example, Shultz and Saporito's (1996) recommendations include using a combination of product markings and labeling technologies, educating customers, encouraging legislation for IPR and participating in coalitions.

More contemporary articles that make strategy recommendations include Berman (2008), Staake and Fleisch (2008), Stumpf and Chaudhry (2010), Li (2013), and Stevenson and Busby (2015). Berman (2008) offers a variety of potential courses of action, including establishing investigations (internal or external to the firm), using product authentication technologies, controlling outsourcing, training customers, and monitoring markets for counterfeits. Li (2013) extends Berman (2008), discussing the advantages and disadvantages of various product authentication, tracing, and tracking technologies, including watermarks, RFID, digital product coding and laser markings, among others.

Stumpf and Chaudhry's (2010) cross-country research evaluated managerial perceptions of various anti-counterfeiting actions, generating five recommendations for approaching the problem from a less U.S.-centric approach, including improving global discourse and media attention on what encourages counterfeit production and buying in different countries, working with agencies to stop the flow of funding for the illicit trade of goods, improving understanding and influencing consumer buying behavior to discourage the purchase of counterfeit goods, and considering and testing various different solutions to similar problems across nations.

Typology of Counterfeit Mitigation Strategies Using the Six Ts (Roth et al., 2008)

During our review of strategies for addressing counterfeiting, several common recommendations emerged, ones that are critical to the conceptual framework we propose for combating counterfeits in supply chains, particularly since they echo the key constructs in Roth and colleagues' (2008) Six Ts framework: Traceability, Transparency, Trust, Training, Time and Testability.

Traceability

Traceability refers to the ability to "map" the supply chain (Roth et al., 2008), specifically the ability to identify and verify the components and chronology of events (Skilton and Robinson, 2009) across supply chain processes. There are ways to improve the traceability of parts and products in the chain, including requiring unique item identification and product authentication technologies (Berman, 2008; Li, 2013; Stumpf and Chaudhry, 2010). Unique physical markings, electronic tracking systems, part numbering and serialization are proposed to assist in preventing and detecting

counterfeiting in the supply-side of the firm's supply chain. These would also be beneficial for B2B customers who also rely on technologies to authenticate items that focal firms provide to the demand-side, thereby ensuring that counterfeit versions of their products do not enter the downstream supply chain (Lehtonen, Michahelles and Fleisch, 2007). Traceability measures must be updated and refreshed, as it is possible for counterfeiters to attempt to replicate them, especially the physical ones (Stevenson and Busby, 2015).

Transparency

Transparency is a measure of completeness of sharing of information via formal and informal agreements (Roth et al., 2008) Improving transparency within the firm, the supply chain and across industries was also a common theme in the proposed strategies to deal with counterfeiting. As previously explained, Stumpf and Chaudhry (2010) are proponents of using what has been successful in some countries to assist other firms in their efforts. Within the firm, Staake and Fleisch (2008) make several recommendations for improving the transparency of information related to addressing counterfeits, such as using defined processes to govern response to counterfeits, monitoring processes, standardized counterfeit reporting tools, and indicators to evaluate the effectiveness of anti-counterfeiting measures. Looking across the supply chain, they recommend having suppliers return all scrap, seconds, and intellectual property as part of their contracts (Staake and Fleisch, 2008). They also suggest improving transparency between business and governmental, including law enforcement, and non-governmental organizations, as do Wilcock and Boys (2013). This is consistent with Shultz and Saporito's (1996)

recommendation to use coalitions to help organizations with similar interests in IPR to leverage pooled knowledge and resources to combat counterfeiting. In a more extreme application of transparency, Minagawa, Trott and Hoecht (2007) propose working with counterfeiters to make them a component of the licit supply chain, rather than a competitor of it.

Testability

In situations where complete transparency is not possible or desired, testing of products can help verify that products are authentic. Testability refers to the ability to detect whether or not expected attributes of a product are present (Roth et al., 2008). Testing can be invasive (destructive) testing or non-invasive (such as inspecting packaging for signs of tampering or alteration). For items such as electronic components, sending samples to independent testing labs is also an option. Sood et al. (2011) proposed a methodology for detecting counterfeit electronic parts that includes a discussion of testing. Like all counterfeit mitigation and prevention strategies, testing has an associated cost and has to be the right fit for a particular firm's needs.

Trust and Time

Complimenting transparency are trust and time. Trust is defined as the expectation that supply chain partners will act in good faith, not opportunistically, and with honesty in negotiations (Roth et al., 2008; Hosmer, 1995). While "blind trust" is not something we would advocate as ideal for supply chains, having a list of "trusted" and qualified suppliers, (particularly those with which the focal firm has a longstanding business relationship) from which to procure parts or materials might reduce the potential

for counterfeit infiltration because these suppliers are motivated to maintain a strong business relationship and not violate the trust of a valuable long-time business partner. Another aspect of trust that can be used to mitigate the risk of counterfeits is to evaluate if signals of trust are present in the purchasing transaction as recommended by Mavlanova and Benbunan-Fich (2010).

Complementing the trust consideration is the time consideration. Time, for our purposes, characterizes the duration of processes within the supply chain (Roth et al., 2008) as well as the aspects of time pressure associated with decision making and customer expectation. Time pressure is related to poor decision making quality (Hahn, Lawson and Lee, 1992). We propose that it is critical to recognize the effects of time pressure on decision making quality in supply chain and purchasing decisions, particularly if a customer has set challenging delivery schedule deadlines or requires rapid responses to requests for proposals.

Training

Another consistently echoed theme among the recommendations and strategies in the literature is the necessity of training, including training of customers, the general public, and stakeholders within the supply chain. For our purposes, training refers to ensuring that the purchasing and supply chain management team are trained (Roth et al., 2008) on the nature of product counterfeits and ways to prevent, detect and eliminate them from the firm's supply chain. Berman (2008), Shultz and Saporito (1996), Stumpf and Chaudhry (2010), and Staake and Fleisch (2008) recommend educating consumers on the risks of counterfeits, including health and safety aspects, as a means to reduce the

level of demands for counterfeiting. They propose a variety of means by which to do this, including 1.) publishing information for users on how to authenticate products and detect counterfeits (Berman, 2008; Staake and Fleisch, 2008), 2.) providing users with information on the risks and impacts of using counterfeits (Stump and Chaudhry, 2010; Shultz and Saporito, 1996), and 3.) providing customers with ways to report suspect counterfeit parts (Berman, 2008).

Within the firm itself, training of personnel is posited to be part of an anti-counterfeiting strategy. Staake and Fleisch (2008) recommend that firms develop country-specific knowledge of the market for counterfeits, the import and distribution routes, the capabilities of counterfeit producers and the consumer market that would procure counterfeit goods. They further recommend that firms should transform the tacit knowledge of counterfeiting experts within the firm into explicit knowledge that can be shared across business units. Finally, they and others (Wilkcock and Boys, 2013) recommend educating purchasing departments on how to spot counterfeit parts.

Potential Research Opportunities

To illustrate how the Six T's framework can serve as a means to categorize the counterfeit mitigation options, we constructed the typology in Table 2.2 to demonstrate how researchers can organize and analyze various strategies proposed in the literature from a supply chain quality management perspective. This table is abbreviated at the source level. See Appendix A for a more detailed list that includes the specific strategy suggestions in each article. The table identifies the number of proposed counterfeit mitigation approaches, revealing several insights for potential research opportunities.

Source	Traceability	Transparency	Testability	Time	Training	Trust
Balfour et al. 2005	1					
Becker 2003	1					
Berman 2008	13	5		1	6	2
Gogo 2010	1	1				
Lehtonen et al. 2007	2					
Li 2012	3	1	1			
Minagawa and Hoecht 2007		3			1	2
Palmer 2006	1					
Shultz and Saporito 1996	1	3	1	1	2	3
Sood et al. 2011			5	1	1	
Staake and Fleisch 2008	4	11	5		14	2
Stevenson and Busby 2015	5	4	1	3	1	7
Stumpf and Chaudhry 2010	3		1		8	3
Grand Total	**35**	**28**	**14**	**6**	**33**	**19**

TABLE 2.2 – SIX Ts TYPOLOGY OF COUNTERFEIT MITIGATION STRATEGIES

First, we observe that one or more than one of the Six T's can be reflected within a proposed mitigation strategy. For example, a strategy that maps to several dimensions of the Six Ts simultaneously is offered by Stevenson and Busby (2015). They propose implementing contracts that include closer relationships, auditing and monitoring. This recommendation maps to three of the Six Ts: traceability, testability and trust. Their observation is important because it acknowledges the multi-dimensional nature of supply chain quality and that a single counterfeit mitigation item can potentially have achieve synergistic improvements in supply chain quality. It also serves as a caution that when conducting empirical research using the Six Ts framework, it is crucial to invest the appropriate amount of construct refinement and development of appropriate measurement scales for these constructs to ensure that instruments are reliable and provide the necessary convergent and discriminant validity.

Another interesting observation in this typology is that it suggests that the time considerations surrounding counterfeit mitigation strategies have received less note and attention in the literature with only six mappings versus the other five, all of which have

14 or more. The time element may be an area where opportunities for new research exist. Some of the time considerations that could be explored include analysis of the relationship between the time between the infiltration of counterfeits and their remediation and the resultant cost impacts. Additionally, exploring the influence of time pressure on the quality of sourcing decisions where potential counterfeit infiltration exists is worthwhile, as it would expand the understanding of the influence of time as a risk factor in purchasing decisions.

2.6 Conclusions

The issue of counterfeiting is a contemporary, critical issue for supply chain management researchers and practitioners alike from both a cost and risk perspective. As all supply chains are vulnerable to this crime, it is critical to understand the sources of the vulnerability. Only then can we hope to provide insights on how to reduce the realized outcomes of this vulnerability, including the impacts to firms, their customers and society in general. The complex nature of counterfeiting and the multiple strategies and deception tactics used by perpetrators of this crime against supply chains requires us as supply chain researchers to expand beyond the traditional agency and information processing theories that dominate our field's research paradigm and to incorporate perspectives from other fields such as economics and criminology. By broadening our approaches and utilizing these additional perspectives, such as Normal Accident Theory and Crime Prevention Theory, we can gain a more thorough understanding of the complete set of antecedents to this vulnerability.

Applying a supply chain quality management lens by employing Roth and colleagues' (2008) Six Ts framework enables us to organize the various options for combating counterfeits by applying a structured set of quality considerations to this phenomenon. This enables us to provide an organization for orienting our continued exploration of this critical issue within supply chain management.

Chapter 3

Essay Two: Avoiding Deceptive Counterfeits: A Behavioral Experiment Informed by Signaling and Crime Prevention Theories

3.1 Introduction

This essay addresses the importance of Signaling and Crime Prevention Theories as a strategy to understand the supplier selection decision process in situations involving a potential deceptive counterfeit situation. Counterfeiting is a pervasive problem for consumers, companies, and governments. From a supply chain management perspective, counterfeit parts are a problem from both a financial and a safety and security perspective. The intended contribution of our research is two-fold. First, we extend the experimental research of deceptive counterfeits into the business-to-business purchasing situation. Prior experimental research has focused on the consumer purchasing domain (Mavlanova and Benbunan-Fich, 2010). Second, we seek to determine if time and workload pressure affect the ability to detect the counterfeit signals.

The costs associated with remediating counterfeits from supply chains and compensating customers can be substantial. In addition to the costs associated with removal and remedy, there can also be fines for knowingly using a counterfeit part, as in

the case with contractors providing supplies to the Department of Defense (NDAA, 2013). In addition to the costs, there are risks associated with counterfeits as a result of the potential substandard construction of counterfeit items, and the health and welfare concerns for those using counterfeit goods as well as those producing them.

Counterfeiting is a criminal activity that is perpetrated against unwitting victims, both consumers and organizations. How can a company protect itself and avoid counterfeits from entering its supply chain and, more specifically, what are the signs available to the purchasing specialist to help identify a situation where a counterfeit item might be offered? Since the purchasing specialist is the individual in the unique position to make a selection decision, it is important that this person be prepared to defend the supply chain against targeting by counterfeit part providers.

To explain how a purchasing specialist can detect signals of counterfeits and avoid the purchase of them, we employ Signaling Theory and Crime Prevention Theory as the theoretical lenses for facilitating our research. Through these lenses we construct an experimental test to determine whether buyers can successfully detect and avoid counterfeit parts in the sourcing decision process. The buying decision serves as a critical moment at which the potential for a counterfeit to enter a legitimate supply chain is either realized or avoided. As such, we focus our research on counterfeit vulnerability to examine how buyers behave when faced with this scenario. With that perspective in mind, we offer the following as specific research questions we seek to answer:

1. Given a specific level of counterfeit signaling, low or high, will a buyer avoid the counterfeit offeror's proposal?

2. Does the amount of time pressure, low or high, affect the quality of the source selection decision?
3. Does the amount of workload pressure, low or high, affect the quality of this source selection decision?
4. Does time pressure interact with the perception of workload pressure to negatively affect the ability to non-select (avoid) the counterfeit offer?

To answer these questions, we present a literature review to define our relevant constructs; ground them in Signaling and Crime Prevention Theories; and develop, execute, and analyze an experiment to test whether a buyer will select a supplier's offer, given one of three levels of counterfeit signaling (low, medium or high) in the proposal at two different levels of workload pressure and two levels of time pressure.

The remainder of this essay is structured as follows. In the literature review we define the concept of deceptive counterfeits, how they can enter legitimate supply chains, what strategies companies can employ to avoid and detect them, and finally discuss the purchasing decision, which we offer as the critical juncture at which the risk of a counterfeit entering a supply chain is either realized or avoided. After the literature review, we present our research model and the four hypotheses that we will test using a scenario-based role playing experiment. In the Experimental Model and Hypotheses Section, we provide a graphical depiction of our experimental model as well as specific variable definitions and develop hypotheses for our test. In the Methods Section, we describe the population of interest and our sample composition as well as the design and execution of our experiment, including pre- and post-design considerations and the

necessary checks such as realism and manipulation checks. We provide a summary of our analysis in the Results Section and finish this essay with the Conclusions Section, which includes a discussion of our findings and implications for practice and research as well as limitations and future opportunities to expand the body of knowledge in this area.

3.2 Literature Review

There are numerous definitions for counterfeits as well as deceptive counterfeits. A thorough discussion on the construct definition and differentiation can be found in Staake, Thiesse and Fleisch (2009) and in the recent working paper by Watson and Roth (2015). We use the Watson and Roth (2015) definition as our definition of a deceptive counterfeit, specifically defining it as "*any product that has been manufactured and/or distributed and sold by an entity that is not authorized by the intellectual property rights' owner and is intentionally misrepresented by the seller as a genuine article."* Deceptive counterfeits are a very specific subset within the broad domain of illicit trade activities (Staake et al, 2009). They are different from non-deceptive counterfeits in that purchasers of non-deceptive counterfeits are very much aware that they are purchasing a fake. For example, if a person knowingly buys a knock-off of a luxury brand item, such as a fake Rolex watch or Coach purse from a street vendor, those purchasers are not deceived in any way; therefore, the purchase is a non-deceptive counterfeit. The intent to deceive and defraud is what differentiates deceptive counterfeits from non-deceptive counterfeits.

Applying Crime Prevention and Signaling Theories to Prevent Counterfeits in Supply Chains

Counterfeiting is a criminal act against intellectual property owners and unwitting businesses and consumers who purchase goods. There are multiple ways that deceptive counterfeits can be produced and presented to legitimate supply chains. Three examples of sources of counterfeits are 1.) overproduction by subcontractors, also known as the third shift or ghost shift (Parloff, 2006), 2.) reverse engineering, particularly if the item is not a technically complex product, and 3.) the recycling of earlier versions of an item or e-waste/scrap items as is seen in the electronic subcomponents sector (SAE, 2015).

With so many potential avenues of entry for counterfeits, how can a company secure its supply chain and avoid their infiltration? There are numerous guidelines available, and several articles have been published on how to address the counterfeit problem from the marketing and brand management academic (Berman, 2008), supply chain management academic (Stevenson and Busby, 2015) and practitioner standards perspectives (SAE, 2009; Department of Commerce, 2010; Aerospace Industries Association, 2011; SASC, 2012). These strategies include everything from legislative to law enforcement, to industry standards, to testing of components and minimizing waste and reuse opportunities, and finally to training purchasing specialists to identify and avoid potential counterfeits (Berman, 2008; Department of Commerce, 2010). The strategies relating to what the purchasing firm can do to avoid the entry fall within the purview of the supply chain management discipline.

As the saying goes, "an ounce of prevention is worth a pound of the cure." This is certainly true for the deceptive counterfeit problem. Avoidance is the best option because it requires far less investment than other approaches, such as testing or remediation after

the problem manifests itself downstream in the manufacturing or distribution process. So, if it is better to avoid counterfeits, how can this be accomplished? In this case, the threat to the supply chain's security is a criminal act, so normal quality management theories may fall short in addressing the deliberate deceit. Recent work by Speier, Whipple, Closs and Voss (2011) applies Crime Prevention Theory to the understanding of supply chain security issues. This theory posits that crime is the result of the combination of an opportune target, a willing offender and lack of sufficient guardianship.

Applying this concept to our specific area of concern, deceptive counterfeits, suggests that companies with supply chain requirements are the opportune target, willing offenders are the counterfeiters seeking to make a profit from the sale of counterfeit goods, and the guardianship is the supply chain and purchasing management infrastructure. Purchasing specialists are the first line of defense and are one of the critical guardians of the quality and security of the supply chain as they serve as the interface between the internal operations of a company and the external marketplace.

Purchasing specialists need to be mindful of the market and avoid potential counterfeits by detecting signals in proposals that a product being offered is not a legitimate good but rather a deceptive counterfeit. Signaling Theory suggests that individuals involved in a transaction can convey information that is either honest or dishonest, causing the other participant to alter his decision making behavior (Spence, 1974; applied to counterfeit situations by Mavlanova and Benbunan-Fich, 2010). Being able to isolate those signals from other considerations in a sourcing decision is no small

challenge as sourcing is not as simple as choosing A, B or C; rather it is a complex decision making process, one that is critical in terms of supply chain security.

The Sourcing Decision – The Tipping Point

Based on the premise that the sourcing decision is the pivotal moment when the potential vulnerability to counterfeit can materialize as a realized counterfeit infiltration, our research examines some of the factors that influence the buyer's ability to detect signals of a deceptive product counterfeit in sourcing documentation. While Mavlanova and Benbunan-Fich (2010) examine this relationship in e-commerce situations where consumers are making a purchase in an electronic environment, we have not found studies examining buyer behavior in business-to-business (B2B) situations. We seek to remedy this gap in the literature by extending this research into a B2B situation.

While all buyers have some knowledge and ability to evaluate offers in the marketplace, the industrial buyer has a larger sphere of influence than a consumer one where the potential impacts of the sourcing decision will not only affect him or her but also the firm as well as the firm's downstream customers or product users. To understand industrial buyer behavior, we consulted Sheth's (1973) seminal work, a model of industrial buyer behavior, as well as additional contemporary research to identify the relevant aspects of buyer behavior to consider in the design of our experiment.

Industrial Buyer Behavioral Considerations

Sheth's (1973) model of industrial buyer behavior is one of the most comprehensive and, arguably, one of the seminal papers in industrial marketing literature. This model identifies three aspects as critical influences on expectations of suppliers in

organizational buyer behavior: 1.) the psychological world of the individual making the decision, 2.) the level of autonomy or jointness in the buying decision, and 3.) conflict that can arise as a result of the buying decision making process. For our purpose the most critical aspect is the psychological world of the buyer, which includes the buyer's background, information sources, the amount of active search, perceptual distortion and satisfaction with past purchases (Sheth, 1973).

Because we are trying to examine how a buyer's decision could potentially cause a counterfeit to enter a supply chain, our research controls the autonomy of the decision making, not allowing the scenario to be a joint one, which, consequently also reduces the potential for conflict. That said, we certainly acknowledge the value of jointness and teamwork in buying situations as the incorporation of engineering, quality, financial and program management viewpoints usually improves the quality of a buying outcome. Extending this research to a joint buying decision would certainly be a meaningful addition to the body of literature.

In terms of the psychological world of the buyer, the background of individuals refers to the educational background, lifestyle, professional values, and demographics of the person (or people, if a joint decision) making the buying decision. Previous experimental research in sourcing has examined experience, education, gender and industry sector as relevant individual characteristics to consider in sourcing decisions (Hall and Roth, 2015). Information sources, which refers to the various means by which buying- related information is communicated to a buyer, includes everything from sales to trade shows, internet search, word-of-mouth or direct mailings and distribution lists.

Active search refers to the amount of effort needed to seek out buying-related information, which Sheth (1973) contends is largely relegated to the purchasing specialist.

Related to the seeking of information is the perceptual distortion that can occur when evaluating information. Purchasing specialists will potentially view objective information differently from engineering or manufacturing specialists (Sheth, 1973). This may be particularly true for counterfeiting signals as an engineer is likely to focus on the quality aspects of a proposal, while a purchasing specialist would potentially focus on the cost and delivery schedule. If counterfeit signals are present in one area and not the other, the ability to detect them would be different for an engineer versus a purchasing specialist. Satisfaction with past purchases refers to the degree to which a buyer (or buying team) perceives that a supplier delivered a product that met the needs of the organization. This satisfaction could vary between members of team. For our research, we controlled for this variable by explaining that our previous suppliers are not available so a new supplier must be found.

In addition to the endogenous aspects that influence expectations among buyers, Sheth (1973) also identifies exogenous factors that can influence the outcome of a buying decision, including product, company, and situational specific factors. Product factors include considerations such as the cost of the item, its riskiness, and time pressure. Time pressure, or the need to make a decision rapidly, is of particular interest to our research. Sheth (1973) contends, and we agree, that time pressure will likely result in the buying decision being delegated to one individual so that is how we designed the decision in our

experiment. In consumer research, time pressure has been shown to adversely affect the quality of decision making in purchasing situations (Hahn, Lawson and Lee, 1992), so it is reasonable to test to determine if time pressure impacts purchasing specialists.

Company specific factors include size, degree of centralization and company orientation. These are factors that we identified and controlled in our experiment. Situational factors, such as price controls, recession, or strikes (Sheth, 1973), also influence a buyer's decision making process. For the purposes of our research we aim to assess the quality of the decision making process in a challenging situation. We propose that a supply chain disruption is a realistic situational factor to study because it requires a company to make a decision on a new supplier in a short timeframe. In addition to the buyer factors proposed by Sheth, it is necessary for us to understand what aspects of the purchase are of greatest importance to the buyer.

Supplier Selection Criteria

There has been much discussion in the operations management literature on the criteria that buying firms use to select suppliers. Some of these criteria are related to the product being purchased, such as the price or product quality, while others relate to the characteristics of the supplier, including supplier finances, service, or technology capability. In research in the automotive industry including manufacturers and direct and indirect suppliers, Choi and Hartley's (1996) factor analysis identified eight supplier selection factors based on an initial 26 supplier selection criteria. These were finances, consistency, relationship, technological capability, service, reliability and price. Krause, Pagell and Curkovic (2001) examined competitive priorities for purchasing and found

them similar to the competitive priorities for operations management, identifying the five factors of cost, quality, delivery, flexibility and innovation. More recently, in a review of multi-criteria decision making for evaluating suppliers, Ho, Xu and Dey (2010) identified quality, delivery and price/cost as the most frequently used evaluating criteria. Ho et al. (2010) also identified manufacturing capability, service, management, technology, research and development, and finance as additional frequently used criteria. Each of these criteria were identified in at least 23 papers published between 2000 and 2008.

Price is a particularly troublesome aspect of purchasing. By and large, purchasing specialists are charged to get the best deal that they can when procuring materials, components, sub-assemblies and the like. That said, there is a point where the price is simply "too good to be true." An item that is priced too low or below the normal competitive range should raise suspicion in terms of its legitimacy or its provenance. In the context of deceptive counterfeits, this is often the case. We specifically modeled the price as too low in our high counterfeit signal groups.

Purchasing and supply chain managers have a substantial task in evaluating and assigning priority to these criteria. While the extant literature identifies quality, price and delivery as the principal criteria, there is not necessarily consensus on which of these factors is most important. In research combining a survey of perceived importance and a discrete choice analysis experiment of supplier selection, Verma and Pullman (1996) found that while buyers espouse the importance of quality, they actually select suppliers based on cost and delivery. Subsequent research conducted by Gray, Roth and Tomlin (2009) found the same to be true in a survey of manufacturers' outsourcing priorities.

Choi and Hartley's (2001) research, which contradicts these findings, concluded that price was one of the least important considerations in supplier selection, while delivery and quality (together comprising a single factor of consistency) were the most important selection criteria. One potential explanation for this is that the concepts of cost and price, while related, are different from each other. The lack of consensus in the literature is not surprising since the reality of sourcing is that there are situational factors that affect the degree of importance of each factor.

For the purposes of our research, we focused on the selection criteria of cost, quality and delivery, as these three factors are the most universally applied to sourcing research (Giffi, Roth and Seal, 1990; Gray et al., 2009). We carefully applied counterfeit signals to both the cost and quality factors, offering only a little variation in proposed delivery schedules in the design of our experimental scenario to ensure it is a comprehensive and realistic depiction of a real-world sourcing decision problem.

3.3 Research Model and Hypotheses

Figure 3.1 is a graphical depiction of the specific research model we examined using a web-based role-playing scenario experiment methodology. It represents a 3x2x2 factorial experimental design, with three independent variables of interest; 1.) the level counterfeit signaling in the counterfeit supplier's offer, 2.) workload pressure and 3.) time pressure. Our dependent variable is the binary outcome representing the avoidance (versus selection) of the counterfeit supplier's offer. In addition to the direct effects of the workload and time pressure variables, we also propose that their interaction has an

additional moderating effect on the strength of the relationship between counterfeit risk signals and supplier avoidance.

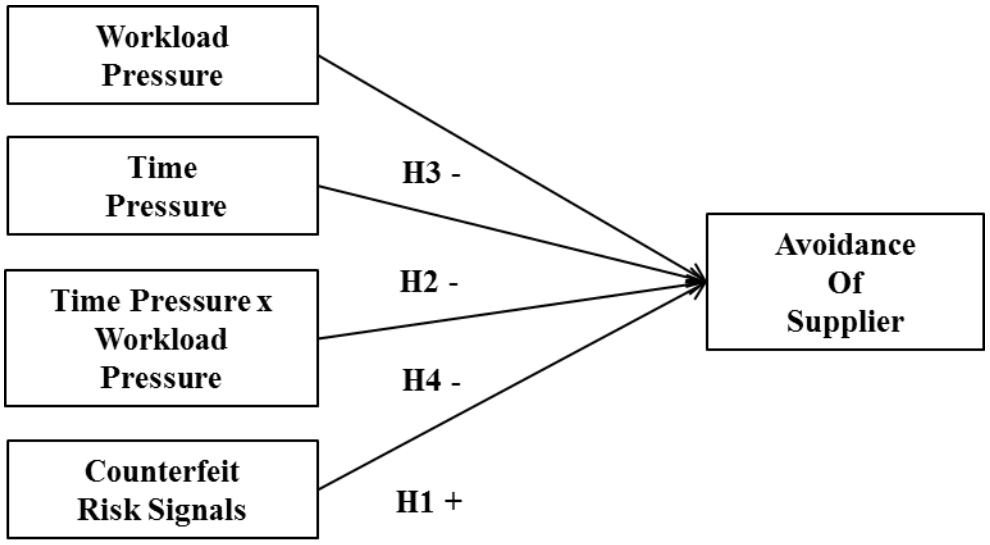

FIGURE 3.1 – COUNTERFEIT SUPPLIER AVOIDANCE EXPERIMENTAL MODEL

In addition to assessing the actual selection or avoidance of the counterfeit supplier, we asked the participants to report the extent to which they preferred their given supplier over the supplier they did not select. As a corollary to our hypothesis regarding counterfeit signals and their effect on supplier avoidance, we posited that the degree of supplier preference would also be positively related to counterfeit signals. That is to say that we expected that those in the high and medium level counterfeit signal groups would display a greater preference for their chosen supplier because they were responding to specific elements of the supplier's proposal that they find inadequate or unsatisfactory.

As depicted in Figure 3.1, the experimental model contained the operational independent variable of counterfeit signaling and the dependent variable of counterfeit supplier avoidance. We define counterfeit risk signals, our independent variable,

specifically as the *combined set of product information, situational factors and supporting information available about the supplier to a potential buyer indicating that an offered product has a risk of actually being a counterfeit item rather than the genuine article*. Counterfeit risk signals are poor attempts at deception that a buyer can, if properly identified, use to weed out and non-select a potential counterfeit supplier. Practitioner literature and expert interviews suggest that missing or incorrect part numbers, lot numbers, and incomplete or missing parts traceability information are all signals of a potential counterfeit situation (Metz, 2013; Livingston, 2013) in addition to the previously mentioned price that is too low.

We posit that two types of pressure will also affect the counterfeit supplier avoidance, specifically, the variables workload pressure and time pressure. We define workload pressure as *the set of experimental cues intended to make the participant feel that his role as a purchasing specialist is particularly overburdened with many work duties to accomplish.* We define our second moderating variable, time pressure, as *the degree to which the time available to make a decision is constrained.* Finally, we define our dependent variable, counterfeit supplier avoidance, as *successfully avoiding selection of a supplier offering a deceptive product counterfeit*.

Hypotheses

Our first hypothesis describes the predicted negative relationship between the level of counterfeit signaling and the decision to avoid a deceptive product counterfeit supplier. Our specific hypothesis is:

H1: The level of counterfeit signaling will be positively related to counterfeit supplier avoidance.

This hypothesis is based on Economic Signaling Theory, which was originally employed by Spence (1973, 1974) to explain job market signals and feedback. This theory was subsequently tested in deceptive counterfeit purchasing situations for consumers by Mavlanova and Benbunan-Fich (2010) and further investigated in exploratory research by Stevenson and Busby (2015). Signaling Theory, as applied to counterfeit situations, suggests that agents can convey information, either honest or dishonest, that causes a principal to alter his/her behavior, particularly in situations where information asymmetry exists. In the case of counterfeiting, success depends upon masking attributes of the item that would signal it is a fake and highlighting attributes that make the item appear genuine (Mavlanova and Benbunan-Fich, 2010). We posit that if the signals are incomplete or inconsistent with expectations, a purchasing specialist should avoid selecting that item.

Crime Prevention Theory states that sufficient guardianship can help prevent a crime from occurring. As the point of entry into a company's supply chain, purchasing specialists are in the unique position to serve as guardians. To effectively fulfill this guardianship, they need to be able to detect known signals of counterfeit items. Table 3.1 lists the potential counterfeit signals that might be present in a sourcing decision.

COUNTERFEIT SIGNALS AVAILABLE PRIOR TO SUPPLIER SELECTION
• Part being procured is an obsolete item • Independent parts distributor • Missing certification and industry standard inspection information • Missing/inaccurate part numbers, lot numbers or serial numbers • Product type has history of being counterfeited (e.g. microcircuits, pharmaceuticals) • Supplier is on list of debarred suppliers • Supplier reluctance to provide sample item for inspection • Item priced below the competitive range of previous purchases

TABLE 3.1 – POTENTIAL COUNTERFEIT SIGNALS DURING SOURCING DECISION

While we cannot use all of these signals in our experiment, we mention them all as important considerations for researchers and practitioners alike. For our experiment at the medium level, we included the quality aspects of counterfeit risk signals of 1.) the part is an obsolete item, 2.) the counterfeit supplier is an independent distributor and 3.) the product type, industrial fasteners, has a history of being counterfeited. Additionally, the proposal itself had quality problems, including missing and incomplete information regarding lot numbers and industry certifications. At the high level of signaling, we included a price that is substantially below the competitive range listed in the scenario's part history information in addition to all of the elements included in the medium level of counterfeit risk signals.

In a perfect world, purchasing specialists would have ample time and workload levels to conduct thorough information searches and evaluations of proposals for each item they procure. In reality, purchasing specialists can be overworked or have to make decisions under time constraints. As this is the reality for most purchasing departments,

we must include these considerations and assess their impact on the quality of decision making in purchasing situations.

Time pressure exists when a person has a limited time to make a decision. This construct has been employed in a wide variety of decision making situations in studies of decision making and risk under time pressure (Kocher, Pahlke and Trautmann, 2013, Ben Zur and Breznitz, 1981). In the situation most relevant to our research, experimental research in consumer purchasing decision making has shown that quality is negatively affected by time pressure (Hahn et al., 1992). This is consistent with Sheth's (1973) inclusion of temporal considerations in his model of industrial buyer behavior. Based on this information, we believe that time pressure will have a negative impact on the purchasing specialist's decision quality. Specifically, we hypothesize that:

H2: The level of time pressure will be negatively related to supplier avoidance.

Simply put, we posit that time constraining the decision process will result in failure to adequately process the signals, thus resulting in lower levels of supplier avoidance in the selection decision.

Similar to time constraints, feeling overburdened with a great deal of work can cause a buyer to develop coping mechanisms, such as problem-solving skills, shortcuts or schemas, to reduce the burden associated with task accomplishment. In these situations, techniques to "work smarter, not harder" may be employed to limit the processing burden associated with tasks. While these mechanisms may improve processing speed, they may inadvertently degrade the quality of decision making by causing the buyer to miss

important and relevant information in the decision situation. Specifically, we hypothesize:

H3: The level of workload pressure will be negatively related to supplier avoidance.

Similar to our hypothesis for time pressure, we posit that workload pressure cues will negative affect the decision process and result in failure to adequately process the signals, thus resulting in lower levels of supplier avoidance in the decision.

Our final hypothesis acknowledges that the combination of workload pressure and a time constrained decision will act synergistically to further detract from the ability to avoid the counterfeit supplier. This interaction will further amplify the noise and detract from decision quality. Specifically, we hypothesize:

H4: Workload pressure and time pressure will interact to further negatively moderate the relationship between counterfeit signaling and supplier avoidance.

We present our 3x2x2 factorial design matrix in Table 3.2.

Group	Counterfeit Signals	Workload Pressure	Time Pressure
1	Low	Low	Low
2	Low	Low	High
3	Low	High	Low
4	Low	High	High
5	Medium	Low	Low
6	Medium	Low	High
7	Medium	High	Low
8	Medium	High	High
9	High	Low	Low
10	High	Low	High
11	High	High	Low
12	High	High	High

TABLE 3.2 – DESIGN MATRIX

3.4 Research Methods

Fundamentally, our research explores the managerial decision making process for purchasing specialists dealing with counterfeit situations that affect supply chains. Studying the human decision making processes that affect operations processes positions our research within the domain of behavioral operations management (Crosan, Schultz, Siemsen and Yeo, 2013). Experimentation is an ideal methodology for sourcing and purchasing management questions and for exploring decision making because it enables the researcher to directly manipulate the variables of interest and draw causal inferences while also relaxing some of the dependency on traditional mathematical modeling assumptions regarding trust and rationality (Bendoly, Donohue and Schultz, 2006). Our experiment is a 3 x 2 x 2 factorial design, with three levels of counterfeit signals and two levels of time pressure and workload pressure.

Target Population and Sample Characteristics

As we explored the ability to detect counterfeit signals during a purchasing decision, our target population was comprised of individuals who participate in purchasing decisions in a business or public sector organization (not consumer purchasing). As noted by Sheth (1973), purchasing decisions can be individual or joint ones. Purchasing specialists, contracting specialists, engineers, supply chain managers and program managers are potential participants in purchasing decisions. With that in mind, we wanted to select a sample of individuals from professional backgrounds that fit the profile of our intended population. We requested participation from the Logistics Officers Association, which is a professional organization of more than 2700 military

officers and civilians in the acquisition, technology and logistics professions. LOA is an appropriate sample because it contains individuals who participate in acquiring and sustaining defense systems, particularly significant here because the defense sector has been identified as a target of deceptive counterfeits. There are additional professional organizations that could also serve as representative samples, for example the Institute for Supply Management, the Council of Supply Chain Professionals, and the National Contracts Management Association.

Sample Composition

Table 3.3 details the demographic information of our sample. As not all of the participants answered all of the demographic questions, the table includes a column providing a response count for each question. There are some notable demographic factors that must be addressed as potential limitations of our sample in terms of generalizability. Firstly, our sample was comprised of individuals who belong to a professional society, which means they may be more interested in doing their jobs well and developing their skills in their fields. Secondly, our sample was predominantly male (76% male versus 24% female), which, while not surprising and consistent with the demographic composition of the military, does present a concern we must address. Previous studies using more general purchasing populations, such as the membership of the Institute for Supply Management (Hall and Roth, 2015), indicate that the gender of purchasing specialists is more evenly distributed, closer to 60% male and 40% female. As such, we specifically tested for gender effects in our models. Our sample was also largely college educated, with 96% having a Bachelor's degree, and 70% holding an advanced

degree (Master's or higher). As these educational attainment rates are higher than those observed by Hall and Roth (2015), we also tested for an education effect to assess whether this difference is relevant to the sourcing decision.

Age			Gender		
	N	**%**		**N**	**%**
20-29	27	24.55%	Male	82	74.55%
30-39	25	22.73%	Female	26	23.64%
40-49	26	23.64%	Not Reported	2	1.82%
50-59	19	17.27%			
60-69	8	7.27%			
70-79	1	0.91%	**Education**		
Not Reported	4	3.64%		**N**	**%**
			High School / GED	0	0.00%
Position Level			Some College	1	0.91%
	N	**%**	Associate's	1	0.91%
Top Management	27	24.55%	Bachelor's	29	26.36%
Middle Management	25	22.73%	Master's	65	59.09%
Supervisor	26	23.64%	Post Master's	7	6.36%
Professional	19	17.27%	Doctoral	5	4.55%
Other	8	7.27%	Not Reported	2	1.82%
Overall N = 110					

TABLE 3.3 – SAMPLE DEMOGRAPHIC SUMMARY

Scenario Based Role Playing Experiments

Because of the potential quality impacts to real-world organizations, field experimentation in an applied setting is not possible without negative consequences. As such, we were constrained to selecting between a laboratory-based or scenario-based experiment. Lab experiments can require substantial investment in facilities and support as well as scheduling of researchers and participants, thus making them cost prohibitive in large scales. Fortunately, our research involved signals present in sourcing

documentation, so we were able to use a scenario-based role playing experimental approach. This approach can leverage the paperless world of internet-based research software platforms to reduce costs while being representative of the real-world purchasing environment, which is largely conducted in the context of electronic commerce and involves reviewing online information to enable decision making. For these reasons, a scenario-based role playing experimental approach is a relevant and effective method for studying the sourcing decision making process in situations with a potential counterfeit hazard.

While scenario-based role playing experiments reduce the investment burden compared to laboratory experiments, it, in no way, should be construed that they require less design effort. Because it is important to make the participant in this method feel immersed in the experience to elicit the desired realistic response, it is of the utmost importance to spend considerable time and effort focusing on the design of the scenario and specific vignettes. We followed the design approach recommended by Rungtusanatham, Wallin and Eckerd (2011), which offers specific considerations in three phases of research: the pre-design, design, and post-design stages.

Pre-Design Stage

The pre-design stage is focused on two areas, becoming familiar with the context of the situation that the research seeks to examine and then understanding the relevant factors that influence it (Rungtusanatham et al, 2011). We conducted extensive literature reviews in the academic and practitioner literature as well as conducted interviews with two subject matter experts in the area of counterfeit problems in industrial buying

situations so that we could craft a realistic scenario that would be representative of a real world purchasing decision. Our working paper on the theoretical bases for exploring the counterfeit phenomena provides a detailed description of our literature review and interview findings (Watson and Roth, 2015). Additionally, we examined existing purchasing documents available on the world-wide web to understand the typical documents that would be used in these purchasing situations.

Design Stage

To develop our experiment's common module and experimental cues module, we followed Rungtusanatham et al.'s (2011) recommendations where we could. We included appropriate purchasing language and formats into the scenario and supporting document artifacts to make them reasonable and representative of purchasing situation artifacts. The deceptive counterfeit phenomenon has not been explored in previous supply chain management research so there were no available vignettes to reuse. That said, our literature review of the practitioner literature provided us with examples of counterfeit items and the paperwork related to them to help construct realistic experimental products.

Post-Design Stage

Once we had initial drafts of the vignettes and questions, we asked purchasing experts to provide reviews, and we conducted two rounds of Q sorts to refine the language to improve the clarity and reliability of the instruments. After we had reasonable instruments, we uploaded them into the Qualtrics online research software and conducted three rounds of pilot testing to further improve the instruments.

Our first round of pilot testing involved a small group (n = 12) of executive supply chain management Master's degree students at a Midwest university using only three of our experimental groups. We used this group of students because they were a reasonable proxy group for our population of interest, purchasing and supply chain management professionals. This group provided initial valuable feedback and constructive criticism in terms of realism and the quality of the experiment.

The next two rounds of pilot testing were conducted using MBA students at a university in the Southeast. This second round of pilot testing was based on refinements from the first round and included a larger scale (n = 90) to allow us to run all of our proposed scenarios. During the second round of pilot testing, we had two levels of each of our factors. The results from the pilot test suggested that it would be worthwhile to add a third level of the counterfeit signal independent variable so that we could isolate the price counterfeit signal (i.e. priced too good to be true) from the non-price elements of the counterfeit signal.

The manipulation checks during the second round identified one error in the design. We had included information that one of the offerors was an "independent parts distributor" in the low level. Since this is a counterfeit signal, it should not have been incorporated. This was subsequently corrected, and the third round of pilot testing provided suitable responses on all of the manipulation checks. Our final round of pilot testing also enabled us to have a complete run of our final instrument. In the end, all pilot rounds were beneficial to improving the overall design, identifying errors, and improving the clarity and realism of the experiment.

Experimental Procedure

As mentioned previously, we prepared our experimental instrument and used Qualtrics software to enable internet distribution and participation. To assist in the recruitment of participants for our research, the Logistics Officers Association sent an invitational email and advertised the request for participation on its website and in its social media post, "The Logistics Pulse." As a result of these efforts, we received 245 responses. Of them, 130 did not agree during the informed consent or did not proceed to answer the selection decision question, and 5 others dropped out of the experiment before completing all of the answers. After these reductions, our remaining sample was a total of 110 participants for an approximate response rate of 3.94%, based on LOA's 2,791 active members. Our experiment was activated for three weeks during the fall of 2015, during which time one reminder advertisement in "The Logistics Pulse" was sent out.

Experimental Design Checks

Manipulation Checks

For the purpose of assessing convergent validity, we examined whether the participants' perceptions of our manipulations were interpreted as we had intended. This is consistent with Perdue and Sommers' (1986) view that manipulation checks ensure that the subject in an experiment is actually aware of and responding to the variables of interest. To test for whether our manipulations were effective, we asked a combination of closed-ended questions and 7-point Likert Scale items. For our counterfeit signal variable, we asked whether the part was an obsolete item and if the supplier was an independent parts distributor. For the time pressure variable, we asked to identify if there

was a timer present in the experiment (only true for the high time pressure groups). Finally, for the workload pressure variable, we asked the participants questions regarding whether they felt pressure (these questions were the Likert-scaled items).

All of our questions, with the exception of the independent parts distributor question, were significant as detailed by the regression summaries in Table 3.4. The fact that the independent parts distributor cues were not processed by the participants may be more attributable to the fact that the participants in the low counterfeit signal group were told that one supplier was a parts distributor while those in medium and high groups were told that the supplier was an independent parts distributor. It is possible that the distinction between the two was too subtle a differentiation for participants to comprehend easily.

DV	**IV**	**N**	**F (1, 108)**	**Prob > F**	**R^2**
ManipObs	CS	110	9.31	.0029	.0794
ManipIndPart	CS	110	0.20	.6562	.0018
ManipTime	TP	110	514.88	.0000	.8266
TooMuchWork	WP	110	16.83	.0001	.1359
LargeQuantityWork	WP	110	3.40	.0677	.0306
FeltOverwork	WP	110	20.78	.0000	.1613

TABLE 3.4 – SUMMARY OF MANIPULATION CHECK REGRESSIONS

Overall, our manipulation checks present statistical support for the fact that the participants were responding to the experimental design.

Realism Checks

In addition to checking whether participants respond to intended manipulations, it is equally important to ensure that the scenarios in the experiment are realistic and represent situations that the sample, and, by extension, the population of interest, encounter in the real world. To ensure our experimental design accounts for this

important consideration, we adapted the scale developed by Pilling, Crosby and Jackson (1994) to assess the extent to which our scenarios were realistic and likely for our participants to encounter in the real world. The answers were based on a 7-point Likert scale with 1 being Strongly Disagree and 7 being Strongly Agree. Table 3.5 details the specific questions and the means and variances of the responses to each question.

Realism Check Question	**Mean**	**Std. Dev**
The scenario described in the study is realistic.	5.66	1.18
I took my role described in the scenario seriously.	6.23	1.01
In my work, I rarely encounter the issues discussed in these scenarios.	3.70	1.87
I am highly aware of the issues raised in this scenario.	5.25	1.70

TABLE 3.5 – REALISM CHECK SUMMARY STATISTICS

These results suggest that our participants found our scenarios to be realistic, familiar and reasonable and that they took their roles seriously. We do note that some of the participants do not encounter these issues in their work. This is not entirely unreasonable for our sample as some members of the Logistics Officers Association work in such fields as aircraft maintenance and thus, do not directly purchase parts. They do, however, manage maintenance actions that utilize the products of business-to-business type transactions.

Common Methods Variance Checks

One potential source of error that must be proactively addressed is the issue of systematic error associated with common methods bias. To address this potential source of bias, we employed two ex-ante items to control for common methods. We inserted four items from the General Self Efficacy scale (Schwarzer and Jerusalem, 1990) and one question on whether childhood vaccination exemptions should be granted only in the case of medical need. We aggregated the responses on the four questions regarding problem

solving from the General Self Efficacy scale (on a 7-point Likert scale for level of agreement) specifically:

"When I am confronted with a problem, I can usually find several solutions."

"I can solve most problems if I invest the necessary effort."

"I am confident that I could deal efficiently with unexpected events."

"I can always manage to solve difficult problems if I try hard enough"

The response on this scale did not relate to the response on our dependent variable, supplier selection. Based on the lack of statistical significance, we can reasonably conclude that common method bias, or systemic error as a result of common instrument, is not present in our data.

When examining beyond a simple regression of the vaccination question on our dependent variable, if we apply Harman's (1976) single factor approach to our common methods variance questions, we find that each individual factor analysis reveals that the five common methods variance questions and the dependent variable do not map well onto a single factor (Eigenvalues all less than 1), suggesting that in total, common methods bias is not present in our model. Finally, Siemsen, Roth and Oliviera (2010) demonstrate common methods variance is less problematic for models that contain interaction terms, even in the case where the additional factors have common methods variance. As our model contains interaction terms, this provides additional support for our assessment that common methods variance is not a problem for our model.

Model Specification

We analyzed our data using logistic regression in Stata 12.0. Logistic regression is an appropriate technique for analyzing relationships involving dichotomous dependent variables. Our model included the independent variables of interest, the moderating effect of the interaction of time pressure and workload pressure, and the demographic variables of interest, specifically age, gender, education level, industry and non-native English language. In our models, Counterfeit Signals (abbreviated CS) has three levels, 0, 1 or 2, with 0 being Low signaling, 1 being Medium level of signaling, and 2 being a High level of signaling. Time Pressure (TP) and Workload Pressure (WP) are binary variables, with 0 indicating that the condition did not apply and 1 indicating that the condition applied to the participant's group. Finally, the interaction of time pressure and workload pressure is indicated as (TP X WP).

We created multiple dummy variables for our categorical demographic variable for Industry Sectors. We had options for twenty industry sectors, but not all of them were used, so we created dummy variables only for those reported in the data using the Stata command tabulate Sector, generate (Industry) to create dummy variables for the 11 sectors reported by participants.

We modeled Education as a categorical variable in ascending order from high school to doctoral degree. Binary dummy variables were created for gender (Male = 0, Female = 1) and non-native English speaking (Native = 0, Non-Native = 1). Additionally, we added variables for capturing purchasing and logistics/supply chain experience, the annual purchasing volume (categorical, ascending in $) and the number of purchases the

participant was involved in during the last year. The specification of our level 1 model is as follows:

$$ln\left[\frac{\widehat{p_i}}{1-\widehat{p_i}}\right] = B_i X_i + B_0 \qquad \text{(Equation 1)}$$

where $\widehat{p_i}$ = the predicted probability of *i* being a case and where *i* = the individual participants in our experiment.

Our Level Two model is written as follows:

$B_i =$ B_0 + B_1 (CS) + B_2 (TP)+ B_3 (WP) + B_4 (TP X WP) + B_5 (Female) + B_6 (Education) + B_7 (Educational Services) + B_8 (Finance & Insurance) + B_9 (Information) + B_{10} (Management of Companies and Enterprises) + B_{11} (Manufacturing) + B_{12} (Other Services (except Public Administration)) + B_{13} (Professional, Scientific, and Technical Services) + B_{14} (Public Administration) + B_{15} (Retail Trade) + B_{16} (Transportation and Warehousing) + B_{17} (Wholesale Trade) + B_{18} (Purchasing Experience) + B_{19} (Logistics / Supply Chain Experience)

(Equation 2)

If, as anticipated, none of the demographic variables are significant, the level two model reduces to the simpler structure of:

$B_i =$ B_0 + B_1 (CS) + B_2 (TP) + B_3 (WP) + B_4 (TP X WP)

(Equation 3)

Another equation we used to examine our model is the unweighted effects coding version, which allows us to make comparisons of means between our sample groups even though the number of participants is not equally balanced across all groups (Cohen,

Cohen, West and Aiken, 2003). For this model, we constructed grouping variables, with our control group (Group 1) as the reference group, which was coded onto the Group2 through Group12 variables with a value of -1, while all other groups were coded as 0 and 1. The unweighted effects coded model specification, with B_0 representing our control group, Group1, is as follows:

$$Y_i = B_0 + B_1Group2 + B_2Group3 + B_3Group4 + B_4Group5 + B_5Group6 + B_6Group7 + B_7Group8 + B_8Group9 + B_9Group10 + B_{10}Group11 + B_{11}Group12 + r_i$$

While in most cases, using ordinary least squares regression on a dichotomous dependent variable produces coefficients that are difficult to interpret, in this particular case, the coefficients represented the differences in means compared to the mean of Group1, which is simply the proportion of participants who avoided the counterfeit supplier in the selection decision.

3.5 Results

Logistic Regression

We analyzed our data using logistic regression. When we constructed the model as detailed in Equation 2, which included the demographics as predictor variables, only counterfeit signaling and the supply chain experience demographic variable were significant predictors of the selection decision. The logistic regression model results for the relationships of interest, including demographics, as specified in Equation 2 are presented in Table 3.5.

In terms of finding support for our predicted relationships, only one of our four hypotheses was supported. We found the level of counterfeit signaling to be a significant predictor of supplier avoidance. That is to say, participants had a higher probability of avoiding the counterfeit supplier in the medium and high counterfeit groups than the participants assigned to the low level groups for the counterfeit signal variable. Additionally, we found that the years of supply chain or logistics management experience was a significant predictor of counterfeit avoidance. As the years of this experience increased, the probability of avoiding the counterfeit supplier increased.

		Model	
Variable	**Hypothesis**	**Coefficient**	**Std Error**
Intercept		-2.611	1.847
CS	**1**	**1.018****	**0.294**
WP	2	.895	0.759
TP	3	-.591	0.773
TP X WP	4	-.172	1.033
Female		-.465	0.597
Education		.134	0.337
Industry			
1. Manufacturing		-.756	1.201
2. Wholesale Trade		Omitted	
3. Transportation & Warehousing		Omitted	
4. Information		.170	.869
5. Retail Trade		Omitted	
6. Finance & Insurance		Omitted	
7. Prof, Scientific & Technical Services		-.107	1.016
8. Mgt of Companies & Enterprises		-.723	1.07
9. Educational Services		Omitted	
10. Other Services (except Public Administration		.749	.912
11. Public Administration		Omitted	
Purchasing Experience		-0.005	0.049
Logistics / Supply Chain Experience		**0.058****	**0.027**
$N = 98$			$\chi^2(13) = 24.97$

Log Likelihood = -55.114 **Prob > χ^2 = 0.023****

Pseudo R^2 = 0.185

p ≤ 0.05; ***p ≤ 0.01; **Bold indicates statistically significant regression coefficients

TABLE 3.5 – LOGISTIC REGRESSION MODEL STATISTICS

In terms of a simple regression of the supplier selection variable on the unweighted experimental group means, the overall model was found to be statistically significant, with the majority of the group means being statistically different from the reference (Group1) group's mean. The summary of this regression is provided in Table 3.6. In this case, the reported mean is the mean of the Select variable for that Group, which can be interpreted as the proportion of participants in that group who avoided the counterfeit supplier in the selection decision (the Select variable is coded 0 for the counterfeit supplier and 1 for the non-counterfeit supplier), while the coefficients for Groups 2 – 12 represent the difference between the unweighted mean of that Group and mean of all the Groups, which is the coefficient of the intercept (.554). The overall model is statistically significant with an N of 110, 11 degrees of freedom for the model and 98 degrees of freedom for the residual. The F value for the model (F 11, 98) is 2.82, with a p value of .0031, indicating the overall model is a highly significant model.

The groups with the most substantial difference in selection were groups 2 and 4, in which participants were far more likely to select the counterfeit supplier. In these cases where the counterfeit signals were lower, the negative coefficient indicates that the participants were more likely to select the counterfeit rather than avoid it. This is consistent with our hypothesis. It should be noted that Group 3 was only marginally statistically significant at the p < .10 in terms of unweighted mean difference. The small

sample sizes of our groups make it difficult to achieve statistical significance in mean differences in every group.

Group	Counterfeit Signals	Workload Pressure	Time Pressure	Mean	N	Coefficient	P value
1	Low	Low	Low	0.375	8	#	
2	**Low**	**Low**	**High**	**0.000**	**6**	**-0.554**	**0.002*** **
3	**Low**	**High**	**Low**	**0.300**	**10**	**-0.254**	**0.072***
4	**Low**	**High**	**High**	**0.308**	**13**	**-0.246**	**0.050****
5	Medium	Low	Low	0.700	10	0.146	0.296
6	Medium	Low	High	0.400	5	-0.154	0.425
7	**Medium**	**High**	**Low**	**0.818**	**11**	**0.265**	**0.051***
8	**Medium**	**High**	**High**	**0.769**	**13**	**0.216**	**0.086***
9	High	Low	Low	0.700	10	0.146	0.296
10	**High**	**Low**	**High**	**0.857**	**7**	**0.303**	**0.067***
11	High	High	Low	0.750	8	0.196	0.206
12	High	High	High	0.667	9	0.113	0.441
Intercept						0.554	0

*** p <.10, ** p <.05, *** p <.01**

TABLE 3.6 – UNWEIGHTED EFFECTS CODED REGRESSION

Post-estimation Test for Heteroscedasticity

To ensure our model was free of heteroscedasticity, we conducted post-estimation testing on our regression model. For heteroscedasticity, we used the Breusch-Pagan / Cook-Weisberg test (hettest command in Stata 12.0) for heteroscedasticity, which tests to determine if variances are consistent across all fitted values. Not surprisingly, our heteroscedasticity tests were not significant for the selection dependent variable (χ^2 (1) = .09, prob > χ^2 = .762).

Relationship Between Select Decision and Degree of Supplier Preference

While we find that the level of counterfeit signaling does have a significant effect on the avoidance of the supplier, we wanted to examine if there was a substantial

difference in the extent of preference between those who selected the counterfeit supplier (Select = 0) and those who avoided the counterfeit supplier (Select = 1). A simple regression of the outcome of our 7-pt scaled question asking for the extent of preference revealed a significant difference in the degree of preference. The regression coefficient of Prefer was 1.36, which can be interpreted as those in the group who avoided the counterfeit supplier, on average, assessed their preference as higher by 1.36 points on a 7-point scale. Table 3.7 contains the specific regression information.

Source	SS	df	MS			
Model	48.9443	1	48.9443	**F(1, 107)**	**=**	**27.2700**
Residual	192.0649	107	1.794999	**Prob > F**	**=**	**0.0000**
Total	241.0092	108	2.231566	R^2	=	0.2031
				Adjusted R^2	=	0.1956
				Root MSE	=	1.3398

Prefer	Coef.	SE	T	P>t	95% CI	
Select	**1.356798**	**0.259834**	**5.22**	**0.000**	**0.841707**	**1.871889**
Intercept	3.913043	0.197539	19.81	0.000	3.521	4.304

TABLE 3.7 – REGRESSION OF PREFERENCE ON SELECTION DECISION

3.6 Discussion

In terms of our *a priori* model, only H1, the hypothesis that counterfeit signaling is positively related to supplier avoidance, was supported. This result is consistent with Signaling Theory, which proposes that as the level of signaling increases, the ability to detect and process the signal increases. As expected, as the level of counterfeit signaling increased, the participants were more likely to avoid the supplier.

While we found that the medium and high levels of counterfeit signals resulted in supplier avoidance; however, the degree of difference between these two levels was not statistically significant, meaning that we can't conclude that purchasing specialists

specifically avoided an item priced below the competitive range seen in previous purchases. As such, further research is required to isolate and test for this specific consideration. This is also true for the other signals of counterfeits. It is possible that these signals are multi-faceted, and it would be worthwhile to test whether one particular signal is more important than the others. Given the ongoing debate we identified earlier in the article regarding price versus schedule versus quality, understanding the hierarchy of importance of counterfeit signals might prove worthwhile in explaining why counterfeits make it into supply chains even in situations where experienced and qualified guardians exist.

In regards to time pressure, workload pressure and their interaction, we did not find statistical support for these three hypotheses. There are two potential explanations for this. First, our sample size was small (N = 110) relative to what is desired for a 3x2x2 full factorial experimental design, thus limiting the power of our analysis. It is possible that a relationship might exist but that we are unable to detect it in a statistically significant way. Another potential explanation involves our sample group. The members of the Logistics Officer's Association are largely associated with the military, and, as such, may demonstrate a greater ability to deal with high pressure situations, both in terms of workload complexity and time constraints. While this particular sample may not react to time pressure, we did see evidence in our second pilot study that time pressure has an impact on the decision process. To resolve this apparent inconsistency, we recommend that further analysis be conducted with a broader range of purchasing specialists in a variety of supply chains. Finally, the experimental design may not have

been substantial enough to trigger a response to the pressure cues. One method to assess the quality of these pressure cues in evoking an actual stress response is to conduct a test of the experiment in a controlled setting and measure participants' levels of alpha-amylase, a hormone produced by individuals experiencing stress, prior to and immediately following administration of the experiment to objectively measure if participants experience a higher level of stress in the time and workload pressure groups. This approach has been utilized in research in management information systems (Galluch, Grover and Thatcher, 2015)

As our first-order independent variables were not significant predictors of the selection decision, it is not surprising that our hypothesis regarding the interaction effect of time pressure and workload pressure was not substantiated. Again, this is likely the result of the small sample size and its effect on the statistical power of our analysis.

Limitations

As mentioned earlier, there are two primary limitations in terms of the generalizability of our findings. First, our sample was drawn from a professional society in one industry sector. As such it may not be representative of the larger purchasing population across industries in terms of education, gender and personality traits.

The second limitation of our research is that we were not able to directly determine whether price or quality is more important in the decision. The design of our counterfeit signal variable was additive in nature, with price being included at the high level in addition to the quality signals in the medium level. To remedy this problem, the

counterfeit signal variable should have four levels, with the additional level containing price signals only to allow for direct analysis of this relationship.

Opportunities for Future Research

This essay represents an initial study on the behavior of purchasing specialists in terms of their responsibilities as guardians of the supply chain. There are several ways in which this research can be extended. First, there are several dimensions of Sheth's Model of Industrial Buyer Behavior (1973) which we controlled in our design for the sake of simplicity. Several of these factors may influence the quality of decision making in counterfeit situations. Most notably, we limited the purchasing decision to a single buyer acting autonomously. In many business situations, complex and/or expensive purchasing decisions usually involve teams of technical specialists and purchasing experts, so it would be worthwhile to design the experiment to enable two or more people to collaborate on the decision to see if joint decision making improved the ability to detect the counterfeit signals. Doing so would also provide insights into the priorities that different occupational specialties place on price, schedule and quality in purchasing decisions.

Another opportunity for future research is related to understanding the relative importance of each of the counterfeit signals identified in Table 3.2, particularly as they relate to specific types of products or subcomponents. While the price being below the competitive range might be a universally relevant signal of potential counterfeiting, some of the other signals may be more or less relevant across different types of purchases. Incorrect lot or part number information would clearly not be relevant in a situation

where raw materials are being purchased. Developing and typologies or taxonomies of counterfeit signals would provide insights into the phenomena that would benefit practitioners and potentially enable tailoring of counterfeit prevention training and development of quality controls for purchasing decisions.

A final recommended extension of this research stream is to assess the effects of prior experience with counterfeiting and training on counterfeits on the quality of the purchasing decision. This would provide additional insights into the guardianship of the supply chain that might improve the firm's ability to avoid counterfeit infiltration. To be comprehensive, further research should examine what elements of training and experience have the most benefit to supply chains.

From a methodological perspective, we employed a scenario-based experimental design because it allowed for control and ease of execution by means of distribution via email and participation in a distributed setting at a time that was convenient for participants. To broaden the understanding of the counterfeit problem in applied settings, case-based research and surveys could be employed as methods to explore the phenomenon. Case-based research would be particularly useful in refining the list of potential signals of counterfeits by working with companies that have experienced counterfeit problems in their supply chains.

3.7 Conclusion

The goal of this research was to add to the body of knowledge in supply chain management regarding deceptive counterfeits, which is an important contemporary problem facing practitioners across all supply chains. Using a Signal Theory and Crime

Prevention theoretical lens to examine the problem, we constructed a realistic and effective set of scenarios to test whether purchasing and supply chain personnel could detect signals of counterfeits in purchasing decisions.

Overall, our effort has contributed to answering the call to examine supply chain security issues, which is a growing stream of literature in our discipline that is of paramount importance to practitioners. This experiment successfully extends the work of Mavlanova and Benbunan-Fich (2010) from the consumer into the B2B sector, testing a set of counterfeit signals proposed in the practitioner literature and knowledge base. We found that an increase in the collective level of signals of a potential counterfeit situation (e.g. parts obsolescence, item having been subject to counterfeiting in the past, priced below the competitive range, and missing and inaccurate proposal, part numbers and lot numbers) had the collective effect of causing participants to avoid selection of the counterfeit supplier.

While we also sought to understand the effects of time and workload pressure in the decision making process where counterfeits are concerned, we did not have sufficient power, largely the result of our small sample size, to find a meaningful relationship between these proposed sources of noise and the ability to successfully detect counterfeit signals. Future research should focus on refining the time and workload pressure measures and determining what types of adaptive and compensating behaviors assist in overcoming them.

Due to our small sample size and frame, we recognize the limitations of the generalizability of the findings of our research. To improve the overall relevance and

reach of this work, future research efforts should test these scenarios using a broader sample of purchasing specialists. This research could also be improved by incorporating considerations for joint or team purchasing decisions by obtaining dyads of purchasing and technical team members and employing a multi-level mixed modeling approach to assess individual and team effects on decisions involving potential counterfeit situations.

Counterfeits remain a real problem for supply chain managers, and we have only begun to explore this phenomenon. Because of the criminal nature of counterfeiting and the potential profits, perpetrators of the crime will continue to adapt and respond to the prevention and detection techniques used to protect supply chains. As such, the research in this area will need to keep pace and evolve over time to react and respond appropriately.

Chapter 4

Essay Three: Objective Versus Perceptual Measures of Time Pressure: An Exploratory Methodological Note

4.1 Introduction

This essay is a methodological note that explores the relationship of perceptual assessments of time pressure and measures of the observed amount of time spent in decision making to determine if these are strongly related to one another. It is also intended to provide insight into whether these two approaches for assessing time pressure are equally valuable in terms of their relationship to actual time constraints and decision quality in a scenario-based role playing experiment involving a business-to-business purchasing situation.

Too often, purchasing specialists are burdened with time constraints, meaning they have only a limited amount of time to spend on a purchasing decision as a result of large workloads or insufficient quantities of personnel in buying organizations. According to a 2014 analysis by Economic Modeling Specialists International in the *Wall Street Journal*, approximately half of purchasing manager positions advertised were going unfilled (Weber, 2014). Given this shortfall, it is reasonable to conclude that existing staff are being asked either to do less purchasing or to spend less time

accomplishing the same purchasing tasks, calling into question the quality of the decision process. Quality failures in supply chains are a relevant contemporary issue in supply chain management, with one of the most cited works in this area by Roth, Tsay, Pullman and Gray (2008) providing a thorough discussion of supply chain quality management.

There has been considerable research on the perception of time versus the actual passing of time in a variety of psychology and marketing books and research journals. Some of the most commonly cited examples include Hornik's (1984) and Antonides, Verhoef, and Van Aalst's (2002) works on consumers' perceptions of time versus the actual time spent waiting in line. Focusing more specifically on the perception of time pressure and decision making are the works of Ben Zur and Breznitz (1981); Zakay and Wooler (1984); Hahn, Lawson and Lee (1992); and, more recently, Kocher, Pahlke and Trautmann (2013). We contend that a thorough understanding of the effect of time on decision making quality requires consideration of 1.) the actual amount of time spent making the purchasing decision, 2.) the perceived amount of time pressure on the part of the individual and 3.) whether actual time pressure (i. e. time constraint) is present in the decision process.

While we found numerous articles related to time and decision making quality in organizational behavior, economics, consumer marketing, and psychology, we found a limited exploration of the combination of these concepts in supply chain management literature. We seek to contribute to remedying this gap in the literature. Understanding the effect of time on the individual purchasing specialist's decision making quality is an important behavioral operations management issue as buyers serve a critical role in

providing both financial and quality value to the supply chain. The decisions made by purchasing specialists and managers have a broad reach and, as such, are important to the success of a firm's operations. Specifically, we seek to answer the following research questions:

1. Do self-reported perceived time pressure responses correlate to the actual time spent making a decision, given a certain level of time pressure?
2. Do the baseline reading time, age and gender of individuals affect the actual time spent on making a decision?
3. Do time pressure (time constraint), perceived time pressure, and actual time spent in decision making affect the quality of a sourcing decision?
4. Do time pressure (time constraint), perceived time pressure, and actual time spent in decision making affect the recollection of information from the decision process?

In addition to contributing to the purchasing decision making body of knowledge, we also provide a methodological contribution by determining if perceptual measures of time pressure provide additional clarity to the decision making quality above and beyond the actual time spent making the decision. Understanding this relationship can help improve the design of behavioral experiments in supply chain management.

To answer our research questions, we constructed an *a priori* model of our variables of interest. We gathered data for analysis as part of a scenario-based role playing experiment involving the selection of a supplier in a potential counterfeit risk situation. As part of the experiment, we obtained data on the baseline reading time for

participants as well as information on the amount of time they spent on the decision portion of the experiment. In addition to obtaining these measures, we randomly assigned participants to either a time pressured group or to a group without time pressure. After the selection decision, participants were provided with a questionnaire covering the factors that influenced their decision, their perceived time pressure, and their demographic information. The questionnaire items can be found in Appendix B. We then used this information to test our *a priori* model.

The remainder of this essay is structured as follows. We present our *a priori* model, including the definitions of our time and demographic variables, and our hypotheses regarding their relationships to one another and to decision quality and accuracy. After the model is introduced, we describe our data collection methods and present the results of our structural equation model analysis. We then assess the merits of our *a priori* model and present an alternative model in the Discussion Section, concluding this essay with a brief discussion regarding limitations and potential opportunities for additional research related to time and decision quality.

4.2 *A Priori* Model

Based on information from our literature review, we constructed the structural model seen in Figure 4.1as our *a priori* model. This model contains our two time measurement variables, Decision Time (denotated as DecideTime in our model) and Baseline Time (BaseTime), and our independent variable, Time Pressure (TP), as well as our latent variable, perceived time pressure (denoted as PerceivedTimePress in our model). In addition to the time-related variables, we also include age and gender (denoted

as Female) in our model, as previous research has suggested that these demographic items are related to risk aversion and decision outcomes in time pressure situations (Kocher et al., 2013; Hahn et al., 2003). The outcome variables in our model are supplier selection decision quality and accuracy on manipulation check questions.

Variable Definitions and Measurements

Perceived time pressure is defined as the participant's perception that there is insufficient time to complete the given amount of work, a definition that has been applied consistently in management literature (e.g. Cooper, Dewe, & O'Driscoll, 2001; Pearsall, Ellis, & Stein, 2009; Maruping, Venkatesh, Thatcher & Patel, 2015). We modeled this as a latent construct comprised of four items on a seven-point Likert response scale. The measures we used were:

1. I felt like I had enough time to review the information provided for the selection decision.
2. I felt rushed to make a selection decision.
3. Overall, I felt a sense of time pressure when completing the experiment.
4. I felt too rushed to adequately address the supplier selection in this experiment.

Confirmatory factor analysis of our data revealed that these measures map consistently onto one factor (χ^2 = 348.51, Prob> χ^2 = 0.0000), with a factor Eigenvalue of 2.940 and proportion of explained variance of 1.0397 (unrotated). Factor loadings are provided in Table 4.1.

Unrotated Principal Factors Analysis

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.94014	2.88651	1.0397	1.0397
Factor2	0.05363	0.11726	0.019	1.0586
Factor3	-0.06363	0.0385	-0.0225	1.0361
Factor4	-0.10213	.	-0.0361	1

N = 107 Chi2 = 348.51 Prob > Chi2 = 0.000

Factor Loadings (Pattern Matrix and Uniqueness)

Variable	Factor1	Factor2	Uniqueness
I felt like I had enough time to review the information provided for the selection decision.	-0.7138	0.1625	0.4641
I felt rushed to make a selection decision.	0.9394	0.0378	0.1162
Overall, I felt a sense of time pressure when completing the experiment.	0.8837	0.1494	0.1968
I felt too rushed to adequately address the supplier selection in this experiment.	0.876	-0.0589	0.2292

TABLE 4.1 – CONFIRMATORY FACTOR ANALYSIS OF PERCEIVED TIME PRESSURE MEASURES

For our objective measures of time, we gathered two data points for each participant. First, we obtained a measure of baseline time by monitoring the amount of time spent on the screen that provided the background information on the scenario. Software captured the start and end times for the page, so subtracting the start from the end calculated the amount of time spent on the page, which we termed Baseline Time. The second measure of time, which was gathered during the decision process page, was calculated in the same manner. We defined this as Decision Time. The rationale for obtaining these two time measures was to determine if general processing times, which vary based on the individual, have an effect on our outcome variables. If so, we can isolate and control for this effect.

The final time element in this model is time pressure, which is the actual time limited condition that was randomly assigned to participants in the experiment. In the time pressure condition, participants were given a written cue in the scenario that they

have five minutes to make the decision before a meeting. Additionally, a clock was displayed that counted up to five minutes.

The Female variable in our model was a dummy variable coded 0 for males and 1 for females, based on the self-reported gender question in the post-experiment questionnaire. Age, which was measured in years, was also self-reported by the participant.

The outcome variables of interest in our model were selection decision quality and manipulation check accuracy. The selection decision quality was a binary outcome variable. In the scenario, one of the suppliers was a potential counterfeit supplier and the other was not. Participants who selected the counterfeit supplier were coded as 0, while participants who selected the non-counterfeit offer were coded as 1. Manipulation check accuracy was scored on a 4-point scale from 0 to 3, with a 0 indicating none of the manipulation checks were answered correctly and a 3 indicating that the participant answered all of the manipulation checks correctly. Manipulation check accuracy is a reasonable measure of decision accuracy because the questions assess whether the participant is able to recall the specifics of the particular scenario.

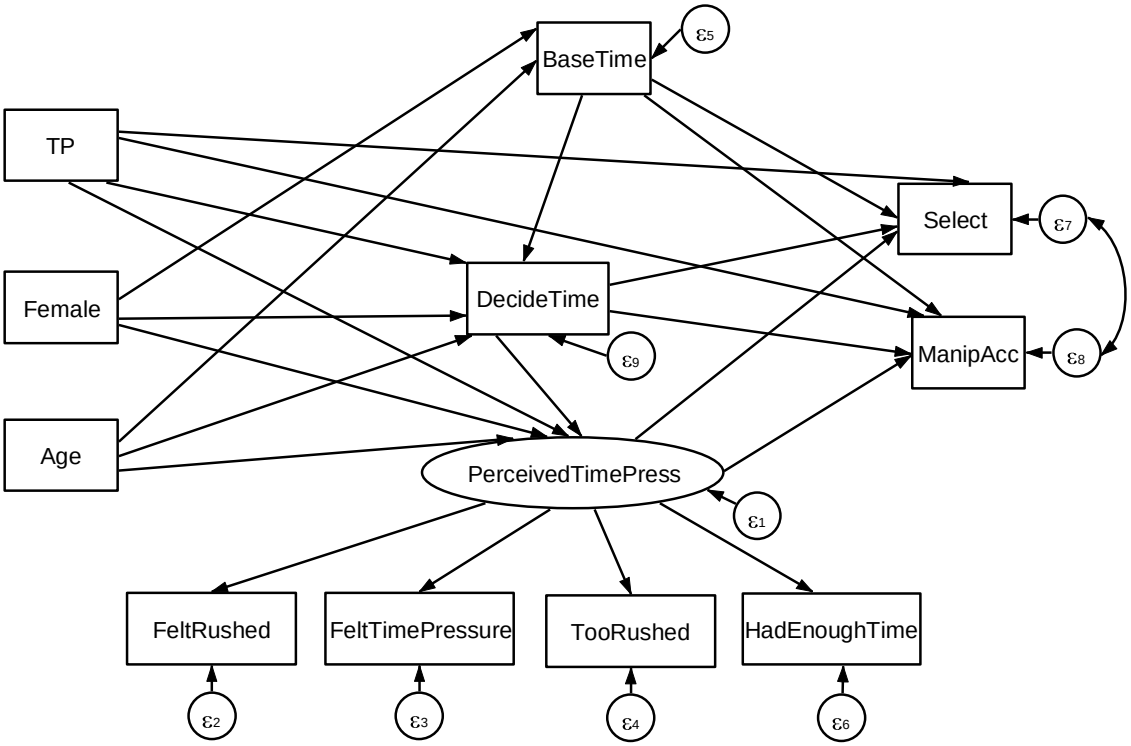

FIGURE 4.1 – *A PRIORI* MODEL OF TIME CONSIDERATIONS AND DECISION QUALITY AND ACCURACY

Hypotheses

Based on our literature review, we developed ten hypotheses regarding the variables in our model. First, we addressed the expected relationships surrounding the actual time pressure condition and the decision time. We expected that assigning a time constraint would reduce the amount of time that participants would spend making the decision and that this response to the time constraint would be consistent with results observed by Kocher et al. (2013). Specifically, our hypothesis was:

H1 – Participants in the time constrained condition will spend less time making the selection decision than the unconstrained condition.

In addition to spending less time making the decision, we anticipated that participants assigned to the time constrained condition would also report higher levels of perceived time pressure. In their experiment, Kocher et al. (2013) found that participants reported feeling more stress and perceived the decision task as more difficult than those in the unconstrained condition. It is reasonable to expect that participants may be overwhelmed by having to accomplish tasks in a short period of time, particularly those with high information loads, the impact of which will manifest in lower quality and accuracy in decision making (Hahn et al., 1992). If the information load is not high, then the time constraints should be less relevant in terms of the decision outcomes. As such, we hypothesize that:

H2 – Participants in the time constrained condition will report higher levels of perceived time pressure than participants in the unconstrained condition.

H3 - The perceived time pressure will be negatively related to the accuracy on the selection decision variable.

H4 - The perceived time pressure will be negatively related to the accuracy on the manipulation check outcome variable.

In general, we expect that participants who spend more time reviewing the information on the background and decision pages of the experiment will absorb more of the relevant information to use in the decision process. This should result in better decision outcomes. As such, we hypothesize:

H5 – Participants with lengthier baseline times will (a) spend more time making the selection decision and (b) make more accurate selection and manipulation check decisions.

H6 – Participants who spend more time making the decision will exhibit more accuracy on the selection decision.

H7 – Participants who spend more time making the decision will exhibit more accuracy on responses to Manipulation Checks

As mentioned when we defined our model variables, there are two demographic factors discussed in the literature that are potentially relevant to our study of time perception and pressure and decision quality. There is a substantial literature stream on age-related effects on cognitive and non-cognitive processing times (see Salthouse, 1996, as a seminal work). As this study used an adult population, we expect that the amount of time spent for both the baseline and decision times will be positively related to age.

H8 – Age will be positively related to a) baseline time and b) time to decide, and negatively related to c) perceived time pressure.

Another demographic consideration is gender. As Kocher and colleagues (2013) found, women are more risk averse in decision making than men. As such, it is reasonable to expect they may take more time to process information to assist in assessing the various risks associated with each supplier's offer in the scenario. As such, the hypothesis for gender was:

H9 – Female participants will, on average, (a) spend more time on the selection decision than males, (b) have higher baseline times than males, and (c) report higher levels of perceived time pressure.

4.2 Methods

As mentioned in the introduction, we used a scenario-based role playing experiment to collect our data. Specific details regarding the scenarios and the post-hoc questionnaire used in the experiment can be seen in Appendix B. The population of interest was purchasing and supply chain management specialists. Specifically, our sample was comprised of 104 members of the Logistics Officers Association, a professional association of logistics and acquisition personnel in the defense sector, both in military and private sector organizations, who responded to an email solicitation containing a hyperlink to the online experiment. We initially received 110 responses; however, as some participants declined to report age and/or gender responses, those cases were not included in our structural equation model analysis. This represents a response rate of approximately 3.5%, based on an email distribution to 2,971 active members of the organization.

In the online experiment, participants were provided a description of their role and the decision at hand, as well as some background information on the part they were purchasing, a specialized industrial fastener. Participants were then given information on the offers from two suppliers and asked to make a purchasing decision between them, one of which was designed to be a counterfeit provider and the other a legitimate one. While

they were reviewing the background information and decision information, the software recorded the start and finish times for each page.

After making their selections, participants were asked a series of post-hoc questions regarding the degree of supplier preference, the importance of various factors in their decision (e.g. quality, cost, delivery schedules), demographic questions and, most important for this research, the manipulation check and perceived time pressure questions. After the data were collected, we analyzed the set for outliers, finding two cases where the times for the decision time variable were more than 7 times greater (times in excess of 7000 seconds) than the next cluster of times. We eliminated these two outliers even though they had only a limited effect on the model. In addition, the incomplete cases in regards to omission of age, gender and/or missing responses to perceived time pressure items were not included in our analysis. Our distribution of genders was also notably skewed, with the predominant number of participants being male. To analyze our data, we utilized Stata 12.0 software to construct our structural equation model and generate the structural and measurement components.

4.3 Results

Figure 4.2 depicts our estimated model. While overall it possesses general goodness of fit for our data, many of the relationships we predicted in our hypotheses were not supported. We present our results in three areas: overall goodness of fit statistics, model estimates, and findings supporting our hypotheses.

A Priori Model Goodness of Fit

In general, our *a priori* model exhibits a satisfactory goodness of fit. The Likelihood Ratio Chi-Square for our model has a low χ^2 value ($\chi^2 = 46.923$, $p > \chi^2 = 0.801$), indicating that we can reject the null hypothesis that our model has perfect fit for the population of interest. Because the hypothesis that a model has perfect fit is largely implausible, additional assessments of fit should be analyzed (Kline, 2005).

Root Mean Square Error of Approximation (RMSEA) is an index that is seen as "parsimony-adjusted," meaning that this formula is structured with a correction for model complexity (see Kline (2005) for the RMSEA formula). As a result, when comparing two models with similar explanatory power, the RMSEA will show a preference for the simpler of the two. The RMSEA actually measures how poorly a model fits; thus, a value of zero for the RMSEA is considered desirable. The RMSEA value for our *a priori* model was 0.000, with a 90% confidence interval lower bound of 0.000 and an upper bound of 0.041.

In addition to RMSEA, we examined the Comparative Fit Index (CFI) and Standardized Root Mean Square Residual of our model (SRMSR). The CFI for our model was 1.000, and the SRMSR was 0.058, both of these values also indicating a reasonable fit. CFI values near 1.00 indicate good fit, and SRMSR values near 0 indicate that bad fit is absent (Kline, 2005).

Model Estimates

Table 4.2 lists the test results for each of the relationships in the structural model for our *a priori* model, including our hypothesized relationships.

Structural Model	Coef	Std Err	Z	P > |z|	95% CI	
Decision Time → Select	0.000	0.000	0.670	0.501	0.000	0.001

Baseline Time → Select	***0.000***	***0.000***	***-1.950***	***0.052****	***0.000***	***0.000***
Perceived Time Pressure → Select	***-0.080***	***0.026***	***-3.060***	***0.002****	***-0.130***	***-0.029***
Time Pressure → Select	0.011	0.101	0.110	0.915	-0.188	0.210
Cons→ Select	0.608	0.109	5.600	0.000	0.395	0.821
Decision Time → Manip Accuracy	0.000	0.000	-1.180	0.236	-0.001	0.000
Baseline Time → Manip Accuracy	0.000	0.000	0.490	0.621	0.000	0.000
Perceived Time Pressure → Manip Accuracy	***-0.071***	***0.041***	***-1.750***	***0.079****	***-0.151***	***0.008***
Time Pressure → Manip Accuracy	-0.169	0.158	-1.070	0.284	-0.478	0.140
Cons→ Manip Accuracy	2.673	0.155	17.270	0.000	2.370	2.977
Baseline Time → Decision Time	0.000	0.004	0.000	1.000	-0.008	0.008
Time Pressure → Decision Time	***-115.344***	***46.189***	***-2.500***	***0.013****	***-205.872***	***-24.815***
Age → Decision Time	***4.214***	***1.840***	***2.290***	***0.022****	***0.608***	***7.819***
Female → Decision Time	-74.543	55.708	-1.340	0.181	-183.728	34.641
Cons → Decision Time	203.041	81.738	2.480	0.013	42.837	363.245
Age → Baseline Time	62.376	44.306	1.410	0.159	-24.461	149.214
Female → Baseline Time	***2501.597***	***1334.403***	***1.870***	***0.061****	***-113.784***	***5116.979***
Cons → Baseline Time	-2371.976	1943.806	-1.220	0.222	-6181.765	1437.814
Decision Time → Perceived Time Pressure	0.001	0.001	0.630	0.527	-0.001	0.002
Time Pressure → Perceived Time Pressure	***1.459***	***0.386***	***3.780***	***0.000****	***0.702***	***2.216***
Age→ Perceived Time Pressure	-0.008	0.015	-0.510	0.612	-0.037	0.022
Female → Perceived Time Pressure	0.451	0.450	1.000	0.316	-0.431	1.333
Measurement Model	**Coef**	**Std Err**	**Z**	**P > |z|**		**95% CI**
Perceived Time Pressure → Felt Rushed	1	Constrained				
Cons → Felt Rushed	3.052	0.683	4.470	0.000	1.713	4.391
Perceived Time Pressure → Felt Time Press	***0.943***	***0.057***	***16.450***	***0.000****	***0.830***	***1.055***
Cons → Felt Time Press	3.305	0.649	5.090	0.000	2.033	4.577
Perceived Time Pressure → Too Rushed	***0.784***	***0.054***	***14.590***	***0.000****	***0.679***	***0.890***
Cons → Too Rushed	2.908	0.542	5.370	0.000	1.847	3.970
Perceived Time Pressure → Enough Time	***-0.720***	***0.078***	***-9.200***	***0.000****	***-0.873***	***-0.567***
Cons → Enough Time	5.128	0.513	9.990	0.000	4.122	6.134
Measurement Model Variances	**Coef**	**Std Err**			**95% CI**	
Felt Rushed	0.291	0.118			0.132	0.645
Felt Time Press	0.864	0.151			0.613	1.218
Too Rushed	0.760	0.135			0.537	1.077
Had Enough	2.078	0.306			1.557	2.774
Select	0.213	0.030			0.162	0.281
Manip Accuracy	0.519	0.073			0.394	0.683
Decision Time	53134.450	7440.312			40381.660	69914.660
Baseline Time	3.17E+07	4432711			2.41E+07	4.17E+07
Perceived Time Pressure	3.336	0.521			2.456	4.532
Measurement Model - Covariances	**Coef**	**Std Err**	**Z**	**P > |z|**	**95% CI**	
Select ↔ Manip Accuracy	***0.095***	***0.034***	***2.75***	***0.006****	***0.027***	***0.162***
*** p < .10, ** p < .05, *** p <.01**						

TABLE 4.2 – *A PRIORI* SEM RESULTS

As detailed in this table, many of the paths that we predicted to be significant were not substantiated; moreover, we found some interesting findings that contradict our hypotheses in some cases. The most significant portion of our model is the measurement model for perceived time pressure, its relationship with actual time pressure, and its resultant effect on selection decision and manipulation check accuracy. The other portion of the model that deserves attention regards decision time and its relationships with two of its predictors, time pressure and age. Table 4.3 summarizes the results as applied to our hypotheses. We elaborate on the insights from each of these in the Discussion Section.

Hypothesis	Path	Coeff	P Value	Conclusion
H1 – Participants in the time constrained condition will spend less time making the selection decision than the unconstrained condition.	Time Pressure → Decision Time	-115.344	0.013**	Supported
H2 – Participants in the time constrained condition will report higher levels of perceived time pressure than participants in the unconstrained condition	Time Pressure → Perceived Time Pressure	1.459	0.000***	Strongly Supported
H3 - The perceived time pressure will be negatively related to the accuracy on the selection decision variable.	Perceived Time Pressure → Select	-0.080	0.002***	Strongly Supported
H4 - The perceived time pressure will be negatively related to the accuracy on the manipulation check outcome variable.	Perceived Time Pressure → Manip Accuracy	-0.071	0.079*	Marginally Supported
H5 – Participants with lengthier baseline times will (a) spend more time making the selection decision and (b) make more accurate selection and (c) manipulation check decisions.	a. Baseline Time → Decision Time b. Baseline Time → Select c. Baseline Time → Manip Accuracy	a. 0.000 b. 0.000 c. 0.000	a. 1.000 b. 0.052* c. 0.621	a. Not Supported b. Not Supported c. Not Supported
H6 – Participants who spend more time making the decision will have more accuracy on the Selection decision.	Decision Time → Select	0.000	.501	Not Supported
H7 – Participants who spend more time making the decision will have more accuracy on responses to Manipulation Checks	Decision Time → Manip Accuracy	0.000	0.236	Not Supported

H8 – Age will be positively related to: a) baseline time and b) time to decide, and negatively related to c) perceived time pressure	a. Age → Baseline Time b. Age → Decision Time c. Age → Perceived Time Pressure	a. 62.376 b. 4.214 c. -0.008	a. 0.159 b. 0.022* c. 0.612	a. Not Supported b. Supported c. Not Supported
H9 – Female participants will, on average, (a) spend more time on the selection decision than males, (b) have higher baseline times than males, and (c) report higher levels of perceived time pressure.	a. Female → Baseline Time b. Female → Decision Time c. Female → Perceived Time Pressure	a. 2501.597 b. -74.543 c. .451	a. 0.061 b. 0.181 c. 0.316	a. Marginally Supported b. Not Supported c. Not Supported

TABLE 4.3 – CONCLUSIONS FOR *A PRIORI* HYPOTHESES

4.4 Discussion

At the start of this essay, we stated that our intended contributions were to provide insights into the relationships between time pressure, both actual and perceived, and purchasing decision quality, including examining the effects of gender and age as potential demographic variables of interest that might affect decision speed and quality of outcomes. In addition, we sought to make a methodological contribution by assessing the relationship between perceived time pressure and time spent making decisions. While our data do not permit us to provide insights into all dimensions of these research objectives, we have several noteworthy findings. We begin our discussion with a description of those findings and discuss some of the limitations of our research. We then transition our discussion toward future research opportunities, presenting a brief review of a simpler, more parsimonious model that appears to be a better fit for our data and conclude with opportunities for future research.

Actual and Perceived Time Pressure and Their Effects on Decision Quality

Overall, our data suggest three important findings regarding time pressure, both actual and perceived. First, actual time pressure is detected by individuals and is related to their self-reported level of perceived time pressure. Our analysis suggests that being in

a time-constrained situation increases the perception of time pressure. In addition to the increased perception of time pressure, actual time pressure reduced the average amount of time spent making decisions, a finding consistent with those of Kocher and colleagues (2013). That said, we did not find support for a subsequent reduction in decision quality as a direct result of actual time pressure.

Second, as predicted, our measures for assessing individuals' perceptions of time pressure adequately map onto our single latent factor of perceived time pressure. Lastly, the perceived time pressure construct provides predictive power in the accuracy of decision making in terms of a supplier selection decision as well as in terms of recollection of information as measured by accuracy on manipulation checks, negatively affecting both outcomes.

Our findings are consistent with those observed by Hahn and colleagues (1992) regarding time pressure, particularly in situations of information overload. These results suggest that perceived time pressure may affect the quality of purchasing decision outcomes. From a supply chain quality management perspective, purchasing specialists are posited to serve as guardians (Watson and Roth, 2015), ensuring that the material input into the firm's supply chain is of suitable quality. Time pressures may negatively affect the quality of purchasing outcomes, adding a quality risk to the supply chain.

Baseline and Decision Times, Age and Gender

While extant literature led us to hypothesize that age, gender and baseline time spent reading the background would be related to decision times, we found support only for the relationship between age and decision time and marginal support for the

relationship between gender and baseline time. Similarly, our prediction that time spent making decisions would be positively related to more accurate results in supplier selection and manipulation check accuracy variables was also not substantiated by our data.

There are two potential explanations for our findings providing only limited support for the relationships involving these variables. First, while we intended the measures of baseline times and decision times to represent the actual time spent accomplishing these tasks, it is possible that some participants were not actively engaged in the tasks for the entire duration the materials were on their computer screens. Since this experiment was conducted in a virtual forum, we have no way of knowing if participants were distracted while accomplishing the tasks (e.g. taking phone calls, working on other activities, responding to emails) or engaged in such behaviors such as surfing the internet, engaging in small talk with coworkers, checking social media or texting on cell phones. It is possible that our direct measures of time have noise in them.

Second, as mentioned at the beginning of this essay, our sample was drawn from a military professional organization and the gender distribution of our participants is skewed, with a larger proportion of males than is observed in other samples of purchasing and supply chain specialists. As such, our failure to find support for the hypothesized gender relationships may be a function of our sample characteristics. While we did not find support for the gender relationships observed in extant literature, we also cannot say that our data conflict, merely that an observed relationship was not present in our data.

Comparing our *a priori* model against an alternative model helps to illustrate the true nature of the relationships of the variables in our data set. This simpler model has an overall better fit for our sample than our *a priori* model.

A More Parsimonious Model

Figure 4.2 presents an alternative model for explaining the relationships observed in our data set.

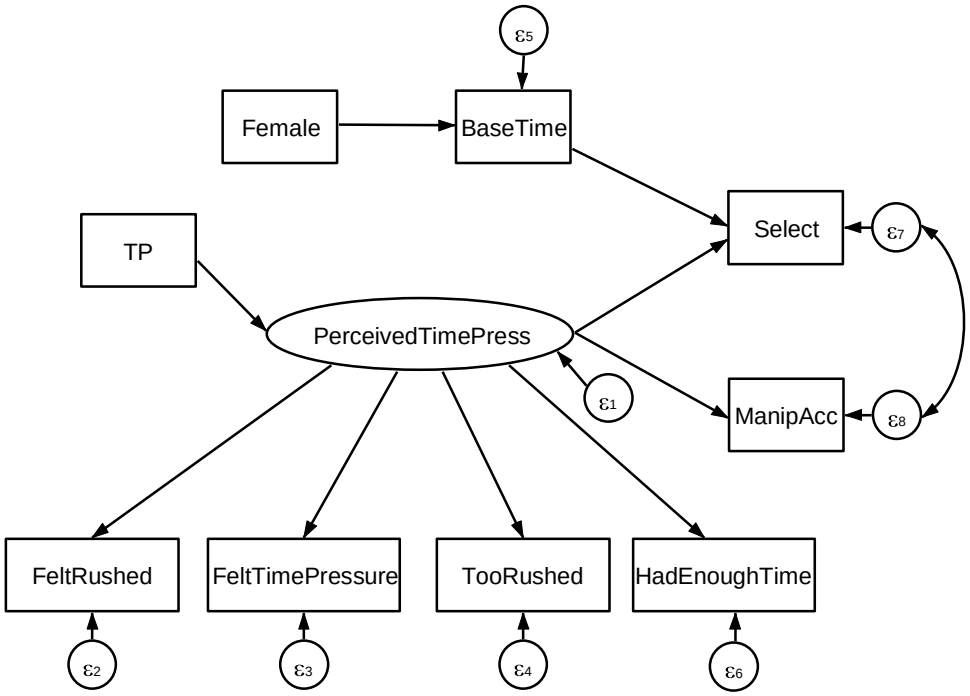

FIGURE 4.2 – ALTERNATIVE MODEL OF TIME PRESSURE AND PURCHASING DECISION QUALITY/ACCURACY

To arrive at this model, we systematically and sequentially removed paths from the *a priori* model that were not statistically significant. The path loadings, measurement model, and test statistics for this model are provided in Table 4.4. As illustrated, there are far fewer paths in this model than in the *a priori* model while maintaining a similar goodness of fit.

The Likelihood Ratio Chi-Square for the alternative model is $\chi^2 = 38.567$, $p > \chi^2 = 0..703$, which is lower than our a prior model's value ($\chi^2 = 46.923$, $p > \chi^2 = 0.801$), and the RMSEA for the alternative model is 0.000 with an lower bound of 0.000 and an upper bound of 0.052. Our *a prior* model's RMSEA is 0.000, with a 90% confidence interval lower bound of 0.000 and upper bound of 0.041. In addition to the RMSEA, we examined the Comparative Fit Index (CFI) and Standardized Root Mean Square Residual of our model (SRMSR). The CFI for the alternative model was 1.000 and the SRMSR was 0.063. The CFI for our *a priori* model was 1.000 and the SRMSR was 0.058.

Overall, the alternative model achieves a similar fit with fewer paths, making it a more parsimonious and elegant model for our data.

Structural Model	**Coef**	**Std Err**	**Z**	**P > |z|**	**95% CI**	
Baseline Time → Select	***-.000***	***7.77e-06***	***-2.17***	***0.030*****	***-.000***	***-1.66e-06***
Perceived Time Pressure → Select	***-.083***	***.024***	***-3.41***	***0.001******	***-.131***	***-.035***
Cons→ Select	.660	.053	12.48	0.000	.557	.764
Female → Baseline Time	***2257.996***	***1284.472***	***1.76***	***0.079****	***-259.522***	***4775.514***
Cons → Baseline Time	215.142	626.758	.034	0.731	-1013.281	1443.565
Time Pressure → Perceived Time Pressure	***1.415***	***.364***	***3.88***	***0.000******	***.701***	***2.129***
Measurement Model	**Coef**	**Std Err**	**Z**	**P > |z|**		**95% CI**
Perceived Time Pressure → Felt Rushed	1	Constrained				
Cons → Felt Rushed	3.027	.256	11.85	0.00	2.526	3.528
Perceived Time Pressure → Felt Time Press	***.951***	***.057***	***16.67***	***0.000******	***.839***	***1.063***
Cons → Felt Time Press	3.280	.256	12.81	0.000	2.778	3.781
Perceived Time Pressure → Too Rushed	***.797***	***.054***	***14.83***	***0.000******	***.692***	***.902***
Cons → Too Rushed	2.900	.219	13.25	0.000	2.471	3.329
Perceived Time Pressure → Had Enough Time	***-.733***	***.078***	***-9.40***	***0.000******	***-.885***	***-.580***
Cons → Had Enough Time	5.13	.236	21.78	0.000	4.670	5.594
Manip Accuracy → Perceived Time Pressure	***-.087***	***.038***	***-2.28***	***0.023****	***-.162***	***-.012***
Cons → Perceived Time Pressure	2.489	.079	31.31	0.000	2.333	2.644
Measurement Model Variances	**Coef**	**Std Err**			**95% CI**	
Felt Rushed	.315	.115			.155	.642
Felt Time Press	.835	.146			.593	1.177
Too Rushed	.738	.131			.521	1.044
Had Enough	2.028	.296			1.523	2.670
Select	.213	.030			.162	.279
Manip Accuracy	.540	.075			.411	.708

Baseline Time	3.14e+07	4337206			2.40e+07	4.12e+07
Perceived Time Pressure	3.255	.505			2.401	4.413
Measurement Model - Covariances	**Coef**	**Std Err**	**Z**	**P > |z|**	**95% CI**	
Select ↔ Manip Accuracy	***.088***	***.034***	***2.56***	***0.011*****	***.021***	***.155***
N = 105, Log Likelihood -2072.194, * p < .10, ** p < .05, *** p <.01						

TABLE 4.4 – SEM RESULTS FOR ALTERNATIVE MODEL

Limitations and Opportunities for Future Research

There are three noteworthy limitations to this research. First, our sample limits the generalizability of our findings. Our sample was obtained from a professional organization in the defense sector. The demographic composition of this sample is different from more general professional organizations of purchasing specialists in terms of gender and education level. As such, we recommend that this study be replicated using a sample that is more representative of our population of interest, purchasing and supply chain specialists. Replicating with a professional group, such as ISM, APICS, or CSCMP, with a broader industry range and more variety in education and gender representation would improve the generalizability of the findings. The second limitation of this research is that our sample size was relatively small and reflects a low response rate. Our small sample size likely contributed to a failure to obtain significance on some of the hypothesized relationships. The replication suggested would also address this limitation of our research.

As mentioned earlier in this discussion section, the third limitation of this research is the issue of not being able to state whether participants were actively engaged in reading the background and decision information their screens. As a result, it is possible that these time measures include a combination of active participation in the experiment and some inattentive behavior or distractions. To overcome this limitation, a future

experiment should be conducted in a lab environment via an alternative form (paper format) where the amount of inattention and the number of distractions could be minimized. Analyzing the results as a nested model would provide a means of comparing and controlling for inattention and distraction, eliminating noise from the objective measures of baseline and decision times.

In addition to the replications mentioned above, there are two other opportunities to extend this research. First, this model of time pressure does not account for familiarity with the subject matter in the decision, nor does it account for the effects of training and experience. To provide more actionable insights for practice, the model should be refined to test for these considerations. Second, we only assessed decision quality in terms of accuracy on the supplier selection and manipulation checks in an experiment. Decision quality is likely a multidimensional construct, and additional outcome variables should be designed and tested to present a more holistic picture of the influence of perceived and actual time pressure on purchasing decision outcomes.

4.5 Conclusion

This research has demonstrated that time constraints and perceived time pressure are related constructs that negatively affect decision quality in a supplier selection decision. These results are consistent with previous studies (Kocher et al., 2013; Hahn et al., 1992) and extends their findings into the domain of purchasing and supply chain management decision making. While our *a priori* model was of satisfactory fit, we identified a more parsimonious alternative model that also fits our data by eliminating paths in the model that were not significant. Further research is warranted to extend this

initial set of findings into more actionable recommendations for managers and practitioners in the purchasing and supply chain management professions.

Chapter 5

Conclusion

The issue of counterfeits in supply chains is a critical contemporary issue that warrants continued attention by practitioners and further research by academia. To contribute this growing field of work, this dissertation focused on examining the counterfeiting issue from a supply chain quality management and behavioral operations perspective.

5.1 Contributions

In Essay One, we developed a conceptual model and research agenda to use to guide supply chain management researchers' efforts in exploring the counterfeit phenomena. Through employing a comprehensive set of theories, including Normal Accident Theory and Crime Prevention Theory, we can gain a more thorough understanding of the complete set of antecedents to this vulnerability.

We illustrated how the Six T's framework can serve as a means to categorize the counterfeit mitigation options, to enable practitioners to select tailored strategies for their supply chain needs. Additionally, we constructed the typology in Appendix A to facilitate continued research on the various strategies proposed in the literature from a supply chain quality management perspective. Our typology suggests that more than one of the Six T's can be reflected within a proposed mitigation strategy, which suggests that multiple

dimensions of supply chain quality can be addressed in a counterfeit mitigation strategy, which potentially can achieve synergistic improvements in supply chain quality.

Essay Two's primary contribution was to confirm that purchasing specialists can detect signals of counterfeits in the purchasing decision process. We extended the work of Mavlanova and Benbunan-Fich (2010) from the consumer marketing research into the supply chain management discipline, and successfully tested a set of counterfeit signals that were proposed in the practitioner literature and knowledge base. We observed that increased potential counterfeit situation caused purchasing specialists to avoid selection of the counterfeit supplier. This finding suggests that purchasing can act as a guardian of the supply chain, potentially helping to prevent the counterfeit crime from being perpetrated against the supply chain.

In Essay Three, we provided insights into the negative effects of time pressure and perceived time pressure in purchasing decision quality. This exploratory work serves to extend previous research into the supply chain discipline, and helps orient future research in understanding the actual and perceived effects of time pressure on sourcing decisions, which is an interesting and contemporary topic in the field of behavioral operations management.

5.2 Implications for Practice

Throughout this dissertation, we observed several important findings that have relevance for the practice of supply chain management. First, we identified areas of vulnerability to counterfeits that supply chain managers can examine within their organizations to help identify and reduce risks.

A second implication from Essay One is that we proposed that counterfeit mitigation strategies can be tied to multiple dimensions of supply chain quality management, which means that firms can evaluate alternative strategies and obtain multiple quality benefits at the same time.

The primary implication for practice from Essay Two is that we find support for the role of purchasing specialists as guardians of the supply chain. Purchasing and supply chain specialists can detect signals of counterfeits in proposals and can avoid them in purchasing decisions. This suggests that the counterfeit signals proposed in practitioner literature are valid and that purchasing specialists should be trained to look for the specific signals that are relevant to their particular industry and purchasing decisions.

Turning to Essay Three, we find that perceived time pressure negatively effects decision quality in a purchasing decision. Given the fact that purchasing specialist positions are going unfilled across the country (Weber, 2014), it highlights that there is a decision quality risk that may occur as a result of manpower shortages in purchasing organizations.

5.3 Future Research

This dissertation serves as an initial contribution towards understanding product counterfeit problem within the context of supply chain management research. There are multiple opportunities to grow this research stream. First, we propose that the conceptual model identified in Essay One be tested empirically to determine the validity of the proposed relationships and their value in predicting counterfeit vulnerability and impacts.

As part of this empirical testing, valid objective and perceptual measures would need to be developed and tested to ensure sufficient construct validity is present.

As mentioned in the discussion section of Essay 2, there are multiple ways to extend the experimental analysis of counterfeit signals in purchasing decisions, including using dyads of technical specialists and purchasing experts, examine how collaboration can affect the ability to detect the counterfeit signals, as well as offer insights into how different functions in an organization perceive the importance of price, schedule and quality in purchasing decisions.

An additional future research mentioned in Essay 2 is to test the relative importance of each of the counterfeit signals identified in our research as they relate to specific types of products or subcomponents. Future research should develop categorizations of counterfeit signals that are industry or situation specific to enable development of tailored counterfeit prevention training and quality controls for purchasing decisions.

A final recommendation for future research from Essay 2 is to test the effects of prior experience and training with counterfeiting in practice, in terms of their impacts on the quality of the purchasing decision. This would continue the exploration of the supply chain manager and purchasing specialist's role as a guardian of the supply chain.

In Essay Three, we observed several limitations with our research that offered opportunities for future research to replicate and extend our work. First, we proposed that our experiment should be replicated in a more controlled environment via an alternative form (paper format) to control for potential slacking behavior and distractions that could

be a source of noise in our objective measures of time. Testing the nested model would provide insight into the noise and potentially reduce the error in objective measures of time.

To improve the practitioner relevance of our time pressure model, future research should examine if additional factors, such as time pressure coping mechanisms, training and experience interact with time pressure to mitigate its impact on decision quality. Finally, the decision quality variable in our model was only measured in terms of accuracy. Future research should assess the effect of time pressure on other aspects of decision quality, such as responsiveness or thoroughness of decision making.

Appendices

Appendix A – Detailed Typology of Counterfeit Mitigation Strategies using the Six Ts of Supply Chain Quality Management (Roth et al, 2009)

Mitigation Strategy	Source	Traceability	Transparency	Testability	Time	Trust	Training
Have an internal investigation division to monitor counterfeits	Balfour et al 2005	**X**					
Establish fake companies to purchase counterfeit goods	Becker 2003	**X**					
Employ private investigators	Berman 2008	**X**					
Establish fake companies to purchase counterfeit goods	Berman 2008	**X**					
Have an internal investigation division to monitor counterfeits	Berman 2008	**X**					
Employ IP protections (trademarks, copyrights, patents)	Berman 2008		**X**				
Consumer education programs on counterfeits	Berman 2008						**X**
Use product authentication technology in demand (consumer) side	Berman 2008	**X**					
Use product authentication technology in supply side operations	Berman 2008	**X**					
Publish information for consumers on how to validate authenticity of products	Berman 2008						**X**
Individual organization can develop advertising about the safety, performance and financial risks associated with counterfeits	Berman 2008						**X**
Trade group development of advertising about the safety, performance and financial risks associated with counterfeits	Berman 2008						**X**
Joint (firms, government and/or Trade group) development of advertising about the safety, performance and financial risks associated with counterfeits	Berman 2008						**X**

Train customers to report counterfeit goods	Berman 2008						**X**
Employ anti-counterfeiting product markings and packaging	Berman 2008	**X**					
Controlling outsourcing	Berman 2008		**X**				
Select suppliers based on trust and past performance	Berman 2008					**X**	
Ensure Outsourcers return tech, production, sales and marketing information	Berman 2008	**X**					
Monitor outsourcing through surprise inspection	Berman 2008					**X**	
Use partial outsourcing to prevent having all resources needed to replicate product	Berman 2008	**X**					
Complete production at internal facilities	Berman 2008	**X**					
Use website monitoring software to search for counterfeits	Berman 2008	**X**	**X**				
Take actions to shut down websites selling counterfeits	Berman 2008		**X**				
Take legal action against counterfeiters	Berman 2008	**X**					
Reduce gray market activity by withholding payment until product verification is complete	Berman 2008	**X**					
Reduce gray market activity by not using wholesalers who also sell in secondary markets	Berman 2008	**X**					
Require suppliers to return all seconds and out-of-spec items for disposal	Berman 2008		**X**				
Develop Cloud-based low resource mobile product authentication systems	Gogo 2010	**X**	**X**				
Use product authentication technology in demand (consumer) side	Lehtonen et al 2007	**X**					
Use product authentication technology in supply side operations	Lehtonen et al 2007	**X**					
Continuously alter product/component characteristics to make it harder to imitate	Minagawa, Trott and Hoecht 2007					**X**	

Collaborate with alleged or suspected imitators to develop products for local sale which would be mutually beneficial in terms of accessing cheapest sources of manufacturing supplies and efficient distribution.	Minagawa, Trott and Hoecht 2007		**X**			**X**	
Price products to attract more customers, which reduces the margin for counterfeits and increases demand	Minagawa, Trott and Hoecht 2007		**X**				
Consider product imitation as part of strategic decision making.	Minagawa, Trott and Hoecht 2007		**X**				
Focus on R&D efforts, since imitators don't have R&D capacity	Minagawa, Trott and Hoecht 2007						**X**
Employ private investigators	Palmer 2006	**X**					
Do Nothing - sometimes this makes sense from a cost/benefit scenario	Shultz and Saporito 1996		**X**				
Co-opt offenders - buy them out and make them part of the licit supply chain	Shultz and Saporito 1996		**X**				
Educate stakeholders at the source - make source countries understand the problems of counterfeits related to their development	Shultz and Saporito 1996						**X**
Don't despise, advertise - train customers to be wary of counterfeits	Shultz and Saporito 1996						**X**
Investigation and surveillance	Shultz and Saporito 1996	**X**					
High Tech Labeling	Shultz and Saporito 1996			**X**			
Create a moving target - keep changing product attributes, packaging, etc.	Shultz and Saporito 1996				**X**		
Legislation	Shultz and Saporito 1996					**X**	
Coalitions	Shultz and Saporito 1996		**X**			**X**	
Cede the industry - developed countries will not keep industries that cannot be protected from IPR infringement	Shultz and Saporito 1996					**X**	
Utilize industry standards for inspection and acceptance of parts sourced in the open market (such as IDEA-STD-1010A)	Sood et al 2011						**X**

Use External Visual Inspection	Sood et al 2011			**X**			
Use X-Ray and other NDI of parts	Sood et al 2011			**X**			
Use Material evaluation and characterization	Sood et al 2011			**X**			
Use packaging evaluation	Sood et al 2011			**X**			
Use Die Inspection on electronic parts	Sood et al 2011			**X**			
Determine the market share of counterfeit goods	Staake and Fleisch 2008						**X**
Investigate the characteristics of the counterfeit producers	Staake and Fleisch 2008						**X**
Understand the properties of the illicit supply chain	Staake and Fleisch 2008						**X**
Analyze the behavior of consumers of counterfeits	Staake and Fleisch 2008						**X**
Conduct a risk analysis and assess the monetary loss	Staake and Fleisch 2008		**X**				
Analyze best practice strategies for anti-counterfeiting from within and outside the industry	Staake and Fleisch 2008		**X**				
Setup or refine your brand and product protect task force	Staake and Fleisch 2008			**X**			
Implement defined monitoring and reaction processes	Staake and Fleisch 2008			**X**			
Assess and select preventative measures	Staake and Fleisch 2008	**X**		**X**			
Consider the implementation of large scale product checks	Staake and Fleisch 2008			**X**			
Signal top-management support	Staake and Fleisch 2008		**X**			**X**	
Develop knowledge of the supply side of counterfeits	Staake and Fleisch 2008						**X**
Develop country-specific knowledge of the counterfeit trade	Staake and Fleisch 2008						**X**
Know the impact of counterfeit trade on your business	Staake and Fleisch 2008						**X**

Know the import roots of counterfeit producers	Staake and Fleisch 2008						**X**
Know the quality of counterfeit producers	Staake and Fleisch 2008						**X**
Know the profiles of consumers of counterfeits	Staake and Fleisch 2008						**X**
Have defined processes to govern response to counterfeits	Staake and Fleisch 2008		**X**				
Have defined processes to monitor for existence of counterfeits	Staake and Fleisch 2008		**X**				
Standardize counterfeit reporting tools	Staake and Fleisch 2008		**X**				
Develop indicators to assess performance of anti-counterfeiting measures	Staake and Fleisch 2008		**X**				
Appoint NGOs to assist in counterfeit issues	Staake and Fleisch 2008		**X**				
Engage government to assist in counterfeit issues	Staake and Fleisch 2008		**X**				
Engage industry groups to assist in counterfeit issues	Staake and Fleisch 2008		**X**				
Protection technologies	Staake and Fleisch 2008	**X**					
Legal actions	Staake and Fleisch 2008					**X**	
Supply-chain security measures	Staake and Fleisch 2008	**X**					
Secure distribution systems	Staake and Fleisch 2008	**X**					
Participation in industry groups	Staake and Fleisch 2008		**X**				
Make anti-counterfeiting knowledge explicit	Staake and Fleisch 2008						**X**
Have multiple authorities across departments on counterfeits	Staake and Fleisch 2008						**X**
Use websites to help consumers be able to identify counterfeits and risky supply channels	Staake and Fleisch 2008						**X**
Educate purchasing departments, suppliers and vendors on how to spot counterfeits	Staake and Fleisch 2008						**X**

Use standardized processes, monitoring and analysis of counterfeits	Staake and Fleisch 2008			**X**			
Employ anti-counterfeiting product markings and packaging	Stumpf and Chaudhry 2010	**X**		**X**			
Individual organization can develop advertising about the safety, performance and financial risks associated with counterfeits	Stumpf and Chaudhry 2010						**X**
Trade group development of advertising about the safety, performance and financial risks associated with counterfeits	Stumpf and Chaudhry 2010						**X**
International discourse on countering the problems	Stumpf and Chaudhry 2010						**X**
Use product authentication technology in supply side operations	Stumpf and Chaudhry 2010	**X**					
Work with media outlets to educate the public on the pervasive issues related to counterfeit foodstuffs, pharmaceuticals, etc.	Stumpf and Chaudhry 2010						**X**
Work with global agencies such as World Bank to immobilize global flow of funds to support counterfeiting activities	Stumpf and Chaudhry 2010						**X**
Reduced Price / Rebate	Stumpf and Chaudhry 2010					**X**	
Offer Site Licenses	Stumpf and Chaudhry 2010					**X**	
Emphasize Warranties	Stumpf and Chaudhry 2010						**X**
Emphasize Benefits	Stumpf and Chaudhry 2010						**X**
Lists of Authorized Sellers	Stumpf and Chaudhry 2010	**X**				**X**	
Stress Harmful Effects of Counterfeits	Stumpf and Chaudhry 2010						**X**
Product Authentication Technologies	Li 2012	**X**	**X**	**X**			
Product Tracking Technologies	Li 2012	**X**					
Product Tracing Technologies	Li 2012	**X**					
Inspections need to be accomplished in short time span to be effective	Sood et al 2011				**X**		

Reporting Counterfeits needs to happen quickly	Berman 2008				**X**		
Re-acquiring obsolete products, incentivising returns by customers and meeting the costs of returns	Stevenson and Busby 2015	**X**				**X**	**X**
Requiring destruction of obsolete products and components, incentivising destruction, e.g. by paying for certificates of destruction or destroyed items, and providing resources for destruction processes	Stevenson and Busby 2015	**X**	**X**			**X**	
Informing inadvertent suppliers of counterfeiters and incentivising them not to supply counterfeiters, paying for intelligence from suppliers, and designing appropriate and perhaps exclusive supply contracts	Stevenson and Busby 2015	**X**	**X**			**X**	
In-sourcing the production of particularly critical materials	Stevenson and Busby 2015	**X**					
Incorporating the potential for 'leakage' in the supplier selection process	Stevenson and Busby 2015					**X**	
Avoiding the over-rapid discontinuation of product lines	Stevenson and Busby 2015				**X**		
Undermining physical functions and appearance, e.g. after a certain shelf life	Stevenson and Busby 2015				**X**		
Making it costly for counterfeiters to change marks and labels that would show components and materials have been in prior use	Stevenson and Busby 2015			**X**			
Designing contracts that prohibit dealings with counterfeiters	Stevenson and Busby 2015					**X**	
Enforcing contracts with closer personal relationships, auditing and monitoring	Stevenson and Busby 2015		**X**			**X**	
Incentivising conformant behaviour, such as by paying for intelligence about counterfeits	Stevenson and B/usby 2015		**X**				
Providing suppliers with strict quantities of materials and components just in time	Stevenson and Busby 2015	**X**			**X**		
Forbidding unauthorised subcontracting by suppliers	Stevenson and Busby 2015					**X**	
TOTALS		**35**	**28**	**14**	**6**	**19**	**33**

Appendix B – Experiment Scenarios and Questionnaire

Welcome to the Buyer, Purchasing and Supply Chain Specialist Decision Making Experiment conducted by Clemson University.

We know your time is precious and we greatly appreciate your participation in this effort. Thank you for your support of this research !

Department of Management

Information about Being in a Research Study conducted by Clemson University Buyer, Purchasing and Supply Chain Specialist Decision Making Experiment

Description of the Study and Your Part in It

Jillian T. Watson and Dr. Aleda V. Roth are inviting you to take part in a research study. Jillian T. Watson, a graduate student at Clemson University is the Project Director, and working with Dr. Aleda V. Roth, Distinguished Professor of Supply Chain Management at Clemson University. The purpose of this research is to examine decision making by purchasing and supply chain management professionals given a variety of information about two notional suppliers, including market research documents, industry analyses and responses to requests for proposals.

Your part in the study will be to serve in the role of a supply chain manager for an automotive parts manufacturer, who has to select a supplier to replace a current supplier that is no longer able to produce the components you require to manufacture your products. It will take you about 15-20 minutes to participate in this role-playing experiment.

Risks and Discomforts - We do not know of any risks or discomforts to you in this research study.

Possible Benefits - We do not know of any way you would benefit directly from taking part in this study. However, this research may help us to understand how certain types of information and incentives affect purchasing and supply chain managers' supplier selection decisions.

Protection of Privacy and Confidentiality - We will do everything we can to protect your privacy and confidentiality. As such, we don't collect any personally identifiable information during this experiment.

Choosing to be in the Study - Your participation in this study is voluntary. You may choose not to take part and you may choose to stop taking part at any time. You will not be penalized in any way if you decide not to participate in the study or stop taking part in the study.

Contact Information - If you have any questions or concerns about this study or if any problems arise, please contact Jillian T. Watson at Clemson University at 571-334-8019, jilliad@g.clemson.edu.

If you have any questions or concerns about your rights in this research study, please contact the Clemson University Office of Research Compliance (ORC) at 864-656-0636 or irb@clemson.edu. If you are outside of the Upstate South Carolina area, please use the ORC's toll-free number, 866-297-3071.

Clicking on the "I agree" button indicates that:

- You have read the above information
- You voluntarily agree to participate
- You are at least 18 years of age

You may print a copy of this informational letter for your files.

Please select whether or not you agree to participate in this effort using the buttons below.

- ○ I AGREE
- ○ I DO NOT AGREE

B2 - SCENARIO INFORMATION – LOW COUNTERFEIT SIGNAL, LOW WORKLOAD PRESSURE, LOW TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – A PURCHASING SPECIALIST

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturers, repair stations, and retail automotive stores. You manage the purchase of approximately 100 components that are used by your company.

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers, Adurmis Fabrication and Agata Solutions. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

These page timer metrics will not be displayed to the recipient.

First Click: *0 seconds*

Last Click: *0 seconds*

#QuestionText, TimingPageSubmit#: *0 seconds*

#QuestionText, TimingClickCount#: *0 clicks*

FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores. The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits. Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - Now out of business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450-1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision.

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA
Type of Supplier	Parts Distributor	Manufacturer
Part Number Offered	ZEN-82-57894	ZEN-82-57894
Lot Number Offered	11462 and 11504	New Lot Numbers beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use inventory from another source	Manufactured under short term license from current supplier
Certification	Parts are American National Standards Institute specification compliant ISO 9001 Certified	Parts are American National Standards Institute specification compliant
Information	SAE AS5553 (Counterfeit Electronic Parts; Avoidance, Detection, Mitigation and Disposition) - Compliant	ISO 9001 Certified Better Business Bureau - A+ Rating
Price per fastener	$1.38	$1.40
Total Price (including shipping and taxes	$6,106.40	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2 - 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata solutions proposal Adurmis fabrication proposal
Demand history data v2 Background

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Please check after you have reviewed the supporting files

☐ I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions	Adurmis Manufacturing
○	○

B3 - SCENARIO INFORMATION – LOW COUNTERFEIT SIGNAL, LOW WORKLOAD PRESSURE, HIGH TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – A PURCHASING SPECIALIST

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturers, repair stations, and retail automotive stores. You manage the purchase of approximately 100 components that are used by your company.

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers, Adurmis Fabrication and Agata Solutions. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores. The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits. Because of volatility of capacity demands, there is no guarantee that orders place with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - Now out of business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 – 1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision. *You have an end-of-day team meeting, so you only have five minutes to complete this review and make a decision.*

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA
Type of Supplier	Parts Distributor	Manufacturer
Part Number Offered	ZEN-82-57894	ZEN-82-57894
Lot Number Offered	11462 and 11504	New Lot Numbers beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use inventory from another source	Manufactured under short term license from current supplier.

Certification	Parts are American National Standards Institute specification compliant ISO 9001 Certified	Parts are American National Standards Institute specification compliant.
Information	SAE AS5553 (Counterfeit Electronic Parts; Avoidance, Detection, Mitigation and Disposition) - Compliant	ISO 9001 Certified Better Business Bureau - A+ Rating
Price per fastener	$1.38	$1.40
Total Price (including shipping and taxes	$6,106.40	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2 - 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata solutions proposal Adurmis fabrication proposal
Demand history data v2 Background

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Please check after you have reviewed the supporting files

I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions ○ Adurmis Manufacturing ○

B4 - SCENARIO INFORMATION – LOW COUNTERFEIT SIGNAL, HIGH WORKLOAD PRESSURE, LOW TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – AN OVERWORKED PURCHASING SPECIALIST WITH A SUPPLY CHAIN PROBLEM

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturers, repair stations, and retail automotive stores. You are a very busy buyer, managing the purchasing of over 100 components that are used by your company, which is twice the normal amount for a buyer. Your workload is demanding and requires you to make numerous purchasing decisions every day, and your supervisor is constantly reminding you of your to-do list and the need to "get those orders filled for our production line".

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job (amongst all of the other tasks mounting on your desk between emails and phone calls from customers and your supervisor) is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers, Adurmis Fabrication and Agata Solutions. . After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores. The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits. Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization

principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - No longer in business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 – 1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision. ***Your supervisor is reminding you to get this decision done ASAP because he's got other tasks for you that will need to be completed before you leave tonight.***

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA
Type of Supplier	Parts Distributor	Manufacturer
Part Number Offered	ZEN-82-57894	ZEN-82-57894
Lot Number Offered	11462 and 11504	New Lot Numbers beginning with A to indicate manufacturing at Adurmis
	Use inventory	Manufactured under

Technical Solution	from another source	short term license from current supplier
Certification Information	States parts are ANSI specification compliant ISO 9001 Certified SAE AS5553 (Counterfeit Electronic Parts; Avoidance, Detection, Mitigation and Disposition) - Compliant	Parts are built American National Standards Institute specification compliant ISO 9001 Certified Better Business Bureau - A+ Rating
Price per fastener	$1.38	$1.40
Total Price (including shipping and taxes	$6,106.40	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2 - 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata solutions proposal Adurmis fabrication proposal Demand history data v2 Background

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Please check after you have reviewed the supporting files

☐ I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions ○

Adurmis Manufacturing ○

B5 - SCENARIO INFORMATION – LOW COUNTERFEIT SIGNAL, HIGH WORKLOAD PRESSURE, HIGH TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – AN OVERWORKED PURCHASING SPECIALIST WITH A SUPPLY CHAIN PROBLEM

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturers, repair stations, and retail automotive stores. You are a very busy buyer, managing the purchasing of over 100 components that are used by your company, which is twice the normal amount for a buyer. Your workload is demanding and requires you to make numerous purchasing decisions every day, and your supervisor is constantly reminding you of your to-do list and the need to "get those orders filled for our production line".

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job (amongst all of the other tasks mounting on your desk between emails and phone calls from customers and your supervisor) is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers, Adurmis Fabrication and Agata Solutions. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores.The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits. Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an

interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - No longer in business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 – 1200	High Price Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision. *Your supervisor is reminding you to get this decision done ASAP because he's got other tasks for you that will need to be completed before you leave tonight. You also have an end-of-day team meeting, so you only have five minutes to complete this review and make a decision.*

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA
Type of Supplier	Parts Distributor	Manufacturer
Part Number Offered	ZEN-82-57894	ZEN-82-57894
		New Lot Numbers

Lot Number Offered	11462 and 11504	beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use inventory from another source	Manufactured under short term license from current supplier.
Certification Information	Parts are American National Standards Institute specification compliant ISO 9001 Certified SAE AS5553 (Counterfeit Electronic Parts; Avoidance, Detection, Mitigation and Disposition) - Compliant	Parts are American National Standards Institute specification compliant ISO 9001 Certified Better Business Bureau - A+ Rating
Price per fastener	$1.38	$1.40
Total Price (including shipping and taxes	$6,106.40	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2 - 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata solutions proposal Adurmis fabrication proposal Demand history data v2 Background

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Please check after you have reviewed the supporting files

I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

○Agata Solutions ○Adurmis Manufacturing

B6 - SCENARIO INFORMATION – HIGH COUNTERFEIT SIGNAL, LOW WORKLOAD PRESSURE, LOW TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – A PURCHASING SPECIALIST

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturers, repair stations, and retail automotive stores. You manage the purchase of approximately 100 components that are used by your company.

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers. They are Adurmis Fabrication and Agata Solutions. Adurmis is a manufacturer and Agata is an independent parts distributor. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores.The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits. Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

PARTS INFORMATION: ***The parts that Fasten-Nation supplies to you are considered "obsolete parts" because the design is not currently manufactured by the original equipment manufacturer. The number of suppliers still manufacturing this type of part is very small and sourcing has been problematic for your company.*** The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - No longer in business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 – 1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision.

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA
Type of Supplier	Independent Parts Distributor	Manufacturer
Part Number Offered	ZEN-82-57894	ZEN-82-57894

Lot Number Offered	Z35012	New Lot Numbers beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use excess inventory from another source	Manufactured under short term license from current supplier.
Certification Information	Parts are American National Standards Institute specification compliant	Parts are American National Standards Institute specification compliant ISO 9001 Certified Better Business Bureau - A+ Rating
Price per fastener	$1.15	$1.40
Total Price (including shipping and taxes	$4,817.80	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2- 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata proposal data v2 Adurmis fabrication proposal Demand history Background

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Please check after you have reviewed the supporting files

☐ I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions ○

Adurmis Manufacturing ○

B7 - SCENARIO INFORMATION – HIGH COUNTERFEIT SIGNAL, LOW WORKLOAD PRESSURE, HIGH TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – A PURCHASING SPECIALIST

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturesr, repair stations, and retail automotive stores. You manage the purchase of approximately 100 components that are used by your company.

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers. They are Adurmis Fabrication and Agata Solutions. Adurmis is a manufacturer and Agata is an independent parts distributor. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores. The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits. Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an

interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

PARTS INFORMATION: ***The parts that Fasten-Nation supplies to you are considered "obsolete parts" because the design is not currently manufactured by the original equipment manufacturer. The number of suppliers still manufacturing this type of part is very small and sourcing has been problematic for your company.*** The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - No longer in business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 - 1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision.

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA
Type of Supplier	Independent Parts Distributor	Manufacturer

Part Number Offered	ZEN-82-57894	ZEN-82-57894
Lot Number Offered	Z35012	New Lot Numbers beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use excess inventory from another source	Manufactured under short term license from current supplier
Certification Information	Parts are American National Standards Institute specification compliant.	Parts are American National Standards Institute specification compliant. ISO 9001 Certified Better Business Bureau - A+ Rating
Price per fastener	$1.15	$1.40
Total Price (including shipping and taxes	$4,817.80	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2 - 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata proposal Adurmis fabrication proposal Demand history data v2 Background

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Please check after you have reviewed the supporting files

I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions ○ Adurmis Manufacturing ○

B8 - SCENARIO INFORMATION – HIGH COUNTERFEIT SIGNAL, HIGH WORKLOAD PRESSURE, LOW TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – AN OVERWORKED PURCHASING SPECIALIST WITH A SUPPLY CHAIN PROBLEM

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturers, repair stations, and retail automotive stores. You are a very busy buyer, managing the purchasing of over 100 components that are used by your company, which is twice the normal amount for a buyer. Your workload is demanding and requires you to make numerous purchasing decisions every day, and your supervisor is constantly reminding you of your to-do list and the need to "get those orders filled for our production line".

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job (amongst all of the other tasks mounting on your desk between emails and phone calls from customers and your supervisor) is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers. They are Adurmis Fabrication and Agata Solutions. Adurmis is a manufacturer and Agata is an independent parts distributor. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores. The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits.

Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

PARTS INFORMATION: ***The parts that Fasten-Nation supplies to you are considered "obsolete parts" because the design is not currently manufactured by the original equipment manufacturer. The number of suppliers still manufacturing this type of part is very small and sourcing has been problematic for your company.*** The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - No longer in business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 – 1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision. ***Your supervisor is reminding you to get this decision done ASAP because he's got other tasks for you that will need to be completed before you leave tonight.***

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA

Type of Supplier	Independent Parts Distributor	Manufacturer
Part Number Offered	ZEN-82-57894	ZEN-82-57894
Lot Number Offered	Z35012	New Lot Numbers beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use excess inventory from another source	Manufactured under short term license from current supplier
Certification Information	Parts are American National Standards Institute specification compliant.	Parts are American National Standards Institute specification compliant. ISO 9001 Certified Better Business Bureau - A+ Rating
Price per fastener	$1.15	$1.40
Total Price (including shipping and taxes	$4,817.80	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2 - 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata proposal Adurmis fabrication proposal data v2 Background Demand history

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Please check after you have reviewed the supporting files

☐ I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions Adurmis Manufacturing

B9 - SCENARIO INFORMATION – HIGH COUNTERFEIT SIGNAL, HIGH WORKLOAD PRESSURE, HIGH TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – AN OVERWORKED PURCHASING SPECIALIST WITH A SUPPLY CHAIN PROBLEM

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturers, repair stations, and retail automotive stores. You are a very busy buyer, managing the purchasing of over 100 components that are used by your company, which is twice the normal amount for a buyer. Your workload is demanding and requires you to make numerous purchasing decisions every day, and your supervisor is constantly reminding you of your to-do list and the need to "get those orders filled for our production line".

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job (amongst all of the other tasks mounting on your desk between emails and phone calls from customers and your supervisor) is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers. They are Adurmis Fabrication and Agata Solutions. Adurmis is a manufacturer and Agata is an independent parts distributor. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a

natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores. The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits. Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

PARTS INFORMATION: ***The parts that Fasten-Nation supplies to you are considered "obsolete parts" because the design is not currently manufactured by the original equipment manufacturer. The number of suppliers still manufacturing this type of part is very small and sourcing has been problematic for your company.*** The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - No longer in business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 - 1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision. ***Your supervisor is reminding you to get this decision done ASAP because he's got other tasks for you that will need to be completed before you leave tonight. You also have an end-of-day team meeting, so you only have five minutes to complete this***

review and make a decision.

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA
Type of Supplier	Independent Parts Distributor	Manufacturer
Part Number Offered	ZEN-82-57894	ZEN-82-57894
Lot Number Offered	Z35012	New Lot Numbers beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use excess inventory from another source	Manufactured under short term license from current supplier
Certification Information	Parts are American National Standards Institute specification compliant	Parts are American National Standards Institute specification compliant ISO 9001 Certified Better Business Bureau - A + Rating
Price per fastener	$1.15	$1.40
Total Price (including shipping and taxes	$4,817.80	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2 - 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata proposal data v2 Adurmis fabrication proposal Demand history Background

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Please check after you have reviewed the supporting files

I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions ○ Adurmis Manufacturing ○

B10 - SCENARIO INFORMATION – MEDIUM COUNTERFEIT SIGNAL, LOW WORKLOAD PRESSURE, LOW TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – A PURCHASING SPECIALIST

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturers, repair stations, and retail automotive stores. You manage the purchase of approximately 100 components that are used by your company.

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers. They are Adurmis Fabrication and Agata Solutions. Adurmis is a manufacturer and Agata is an independent parts distributor. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores.The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits.

Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

PARTS INFORMATION: ***The parts that Fasten-Nation supplies to you are considered "obsolete parts" because the design is not currently manufactured by the original equipment manufacturer. The number of suppliers still manufacturing this type of part is very small and sourcing has been problematic for your company.*** The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - No longer in business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 - 1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for

proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision.

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA
Type of Supplier	Independent Parts Distributor	Manufacturer
Part Number Offered	ZEN-82-57894	ZEN-82-57894
Lot Number Offered	Z35012	New Lot Numbers beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use excess inventory from another source	Manufactured under short term license from current supplier.
Certification Information	Parts are American National Standards Institute specification compliant	Parts are American National Standards Institute specification compliant ISO 9001 Certified Better Business Bureau - A+ Rating
Price per fastener	$1.38	$1.40
Total Price (including shipping and taxes	$6,106.40	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2- 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata response data v2 Adurmis fabrication proposal Demand history Background

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Please check after you have reviewed the supporting files

☐ I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions ○

Adurmis Manufacturing ○

B11 - SCENARIO INFORMATION – MEDIUM COUNTERFEIT SIGNAL, LOW WORKLOAD PRESSURE, HIGH TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – A PURCHASING SPECIALIST

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturesr, repair stations, and retail automotive stores. You manage the purchase of approximately 100 components that are used by your company.

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers. They are Adurmis Fabrication and Agata Solutions. Adurmis is a manufacturer and Agata is an independent parts distributor. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores. The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits.

Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

PARTS INFORMATION: ***The parts that Fasten-Nation supplies to you are considered "obsolete parts" because the design is not currently manufactured by the original equipment manufacturer. The number of suppliers still manufacturing this type of part is very small and sourcing has been problematic for your company.*** The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - No longer in business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 – 1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision.

Supplier	**Agata Solutions**	**Adurmis Fabrication**

Location	City of Industry, CA	Fresno, CA
Type of Supplier	Independent Parts Distributor	Manufacturer
Part Number Offered	ZEN-82-57894	ZEN-82-57894
Lot Number Offered	Z35012	New Lot Numbers beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use excess inventory from another source	Manufactured under short term license from current supplier
Certification Information	Parts are American National Standards Institute specification compliant.	Parts are American National Standards Institute specification compliant. ISO 9001 Certified Better Business Bureau - A+ Rating
Price per fastener	$1.38	$1.40
Total Price (including shipping and taxes	$6,106.40	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2 - 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata response data v2 Adurmis fabrication proposal Demand history Background

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Please check after you have reviewed the supporting files

I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions	Adurmis Manufacturing
○	○

B12 - SCENARIO INFORMATION – MEDIUM COUNTERFEIT SIGNAL, HIGH WORKLOAD PRESSURE, LOW TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – AN OVERWORKED PURCHASING SPECIALIST WITH A SUPPLY CHAIN PROBLEM

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturers, repair stations, and retail automotive stores. You are a very busy buyer, managing the purchasing of over 100 components that are used by your company, which is twice the normal amount for a buyer. Your workload is demanding and requires you to make numerous purchasing decisions every day, and your supervisor is constantly reminding you of your to-do list and the need to "get those orders filled for our production line".

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job (amongst all of the other tasks mounting on your desk between emails and phone calls from customers and your supervisor) is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers. They are Adurmis Fabrication and Agata Solutions. Adurmis is a manufacturer and Agata is an independent parts distributor. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores. The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits. Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

PARTS INFORMATION: ***The parts that Fasten-Nation supplies to you are considered "obsolete parts" because the design is not currently manufactured by the original equipment manufacturer. The number of suppliers still manufacturing this type of part is very small and sourcing has been problematic for your company.*** The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months

	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - No longer in business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months

Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 – 1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have

received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision. ***Your supervisor is reminding you to get this decision done ASAP because he's got other tasks for you that will need to be completed before you leave tonight.***

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA
Type of Supplier	Independent Parts Distributor	Manufacturer
Part Number Offered	ZEN-82-57894	ZEN-82-57894
Lot Number Offered	Z35012	New Lot Numbers beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use excess inventory from another source	Manufactured under short term license from current supplier
Certification Information	Parts are American National Standards Institute specification compliant.	Parts are American National Standards Institute specification compliant. ISO 9001 Certified Better Business Bureau - A+ Rating
Price per fastener	$1.38	$1.40
Total Price (including shipping and taxes	$6,106.40	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2 - 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata response data v2 Adurmis fabrication proposal Demand history Background

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Please check after you have reviewed the supporting files

☐ I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions	Adurmis Manufacturing
○	○

○

B13 - SCENARIO INFORMATION – MEDIUM COUNTERFEIT SIGNAL, HIGH WORKLOAD PRESSURE, HIGH TIME PRESSURE

INTRODUCTION

This experiment involves reading a scenario about a particular purchasing decision and then selecting between two potential suppliers for the component.

YOUR ROLE – AN OVERWORKED PURCHASING SPECIALIST WITH A SUPPLY CHAIN PROBLEM

In this role-playing scenario, you are serving as the purchasing specialist for Alpha Automotive Accessories, a parts manufacturer that produces brakes, airbags, and powertrain accessories used by automotive manufacturers, repair stations, and retail automotive stores. You are a very busy buyer, managing the purchasing of over 100 components that are used by your company, which is twice the normal amount for a buyer. Your workload is demanding and requires you to make numerous purchasing decisions every day, and your supervisor is constantly reminding you of your to-do list and the need to "get those orders filled for our production line".

YOUR TASK - DECIDE BETWEEN TWO SUPPLIERS FOR A COMPONENT

Your job (amongst all of the other tasks mounting on your desk between emails and phone calls from customers and your supervisor) is to evaluate the purchasing situation, review supporting information to help you understand your industry, the suppliers and their offers and make a purchasing decision between two suppliers. They are Adurmis Fabrication and Agata Solutions. Adurmis is a manufacturer and Agata is an independent parts distributor. After reviewing the documentation, you will be asked a series of questions about which supplier to select and why you did or did not select each supplier. Following the experiment, you will be asked questions about your personal demographics, experience and education.

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FASTENER BACKGROUND

Your normal trusted supplier of specialized fasteners, Fasten-Nation Components, has experienced a natural disaster which destroyed their primary production facility and they won't be able to fill customer orders for three months. Your company uses these fasteners on parts for late model vehicles and heavy equipment. Your product line is sold at numerous auto parts stores, dealerships and heavy equipment supply stores. The industrial fastener marketplace has had some problems in terms of quality historically, including substandard materials, product quality inconsistencies and counterfeits. Because of volatility of capacity demands, there is no guarantee that orders placed with US manufacturers will actually be produced domestically. The outsourcing of manufacturing has caused a substantial migration of demand to China, and recent trends show that the domestic sources for the specific type of fasteners you require are diminishing.

Your supply chain management operations have been focused on lean and inventory minimization

principles to help keep operational costs down. Unfortunately, this means that you only have enough stock on hand to continue manufacturing for two weeks. Your supervisor has asked you to select an interim supplier for a limited time supply arrangement as a solution to the problem until your normal supplier is able to resume operations.

PARTS INFORMATION: ***The parts that Fasten-Nation supplies to you are considered "obsolete parts" because the design is not currently manufactured by the original equipment manufacturer. The number of suppliers still manufacturing this type of part is very small and sourcing has been problematic for your company.*** The table below summarizes the history of this part, including the previous sources, their part numbers, lot numbers, and the pricing and quantity lows, averages and highs for your recent purchases of these fasteners.

Supplier History Information – Previous 24 Months				
	Supplier Name	**Type of Supplier**	**Supplier Part Number**	**Supplier Lot Numbers**
Current Supplier:	Fasten-nation Components	Manufacturer	FNC-82-57894A	1086 – 3484
Previous Supplier (Original Equipment Manufacturer - No longer in business):	Zenith Component Manufacturing	Manufacturer	ZEN-82-57894	11200 - 11565

Quantity and Price Information – Previous 24 months			
Average Quantity Procured	569	Average Price Per Item	$1.37
Quantity Range Procured	450 – 1200	Price Range Per Item	$1.25 - $1.65

THE DECISION TO MAKE - DECIDING BETWEEN THE TWO PROPOSALS

You have sent out a request for proposal for new suppliers of the specialized fasteners, and you have received two responses. The table below summarizes the two proposals. Hyperlinks to your request for proposal, the two responses, as well as your demand history data are also provided to enable you to make an informed decision. ***Your supervisor is reminding you to get this decision done ASAP because he's got other tasks for you that will need to be completed before you leave tonight. You also have an end-of-day team meeting, so you only have five minutes to complete this review and make a decision.***

Supplier	**Agata Solutions**	**Adurmis Fabrication**
Location	City of Industry, CA	Fresno, CA
Type of Supplier	Independent Parts Distributor	Manufacturer

Part Number Offered	ZEN-82-57894	ZEN-82-57894
		New Lot Numbers
Lot Number Offered	Z35012	beginning with A to indicate manufacturing at Adurmis
Technical Solution	Use excess inventory from another source	Manufactured under short term license from current supplier
Certification Information	Parts are American National Standards Institute specification compliant	Parts are American National Standards Institute specification compliant ISO 9001 Certified Better Business Bureau - A + Rating
Price per fastener	$1.38	$1.40
Total Price (including shipping and taxes	$6,106.40	$6,206.00
Delivery Timeline	Beginning 2 weeks after order	Beginning 2 - 3 weeks after order

SUPPORTING DATA FILES FOR USE IN YOUR DECISION

Request for quote Agata response data v2 Adurmis fabrication proposal Demand history Background

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Please check after you have reviewed the supporting files

I have reviewed the supporting data files.

Based on your review of the suppliers' proposals, which supplier do you select?

Agata Solutions Adurmis Manufacturing

○ ○

B14 – POST-HOC QUESTIONNAIRE

To what extent do you prefer your selected supplier over the supplier you did not select? Please rate your preference.

1 - No real preference	2	3	4	5	6	7 - Greatly Prefer
○	○	○	○	○	○	○

Please identify how important each of the following factors was in your decision.

	1 - Not Important at all	2	3	4	5	6	7 - Very Important
The supplier's price was the lowest offered.	○	○	○	○	○	○	○
The supplier's ability to meet the required delivery date	○	○	○	○	○	○	○
The quality of the fasteners offered	○	○	○	○	○	○	○
The technical approach (make or use excess inventory) offered by the supplier	○	○	○	○	○	○	○
The risk that the fasteners are counterfeit parts	○	○	○	○	○	○	○
The part history information provided by the supplier	○	○	○	○	○	○	○
The fact that the part was an obsolete item	○	○	○	○	○	○	○

I specifically considered that one of suppliers proposals might be an offer for counterfeit parts.

- ○ Yes
- ○ No

Please describe your level of agreement with each of the following statements regarding the supplier you DID NOT SELECT	1 - Strongly Disagree	2	3	4 - Neither agree nor disagree	5	6	7 - Strongly Agree
The price offered by the supplier was too high.							
The price offered was so low that I thought the product might be a counterfeit.							
The price offered was so low that the quality of the product was questionable.							
The delivery schedule was not acceptable							
The delivery schedule was too slow for the requirement.							
The quality of the item was inadequate for the requirement.							
The fastener has a high chance of being a counterfeit part							
The fastener might be a non-conforming part							
There was insufficient information about where the item was produced, which was a great cause for concern in my decision							
There is likely to be quality risk associated with selecting the lower cost supplier							
Low cost is more important than quality in this purchasing decision							
Quality is less important than schedule in this purchasing decision.							
My concerns about the prospects of receiving counterfeit products overweighed my beliefs about the importance of other operational factors, such as cost and delivery							
My concerns about the costs and consequences of counterfeit product outweighed my feeling about lower unit costs							
I believe that it is possible to control or manage situations that involved counterfeit products.							
I believe that it is possible to stop opportunistic supplier behaviors, such as supplying counterfeit products, in a contract							

Please answer the following questions regarding the realism of this scenario.

	1 - Strongly Disagree	2	3	4 - Neither Agree nor Disagree	5	6	7 - Strongly Agree
The scenario described in the study is realistic.	○	○	○	○	○	○	○
I took my role described in the scenario seriously.	○	○	○	○	○	○	○
In my work, I rarely encounter the issues discussed in these scenarios.	○	○	○	○	○	○	○
I am highly aware of the issues raised in this scenario.	○	○	○	○	○	○	○

Please select your level of agreement or disagreement with each of the following statements.

	1 - Strongly Disagree	2	3	4 - Neither Agree nor Disagree	5	6	7 - Strongly Agree
I felt like I had enough time to review the information provided for the selection decision.	○	○	○	○	○	○	○
I felt rushed to make a selection decision	○	○	○	○	○	○	○
Overall, I felt a sense of time pressure when completing the experiment	○	○	○	○	○	○	○
I felt too rushed to adequately address the supplier selection in this experiment	○	○	○	○	○	○	○
When I am confronted with a problem, I can usually find several solutions.	○	○	○	○	○	○	○
I can solve most problems if I invest the necessary effort.	○	○	○	○	○	○	○
I am confident that I could deal efficiently with unexpected events.	○	○	○	○	○	○	○
I can always manage to solve difficult problems if I try hard enough	○	○	○	○	○	○	○
I felt like a buyer who was overworked in this scenario.	○	○	○	○	○	○	○
As I completed the experiment, I felt there was a large quantity of work that needed to be done.	○	○	○	○	○	○	○
As I went through the scenario, I thought the buyer had too much work to do.	○	○	○	○	○	○	○

There was a timer displayed in this experiment.

- ○ Yes
- ○ No

The fasteners you needed to purchase in this experiment were obsolete parts.

- ○ Yes
- ○ No

One of the suppliers in this scenario was an independent parts distributor.

- ○ Yes
- ○ No

What is your job title?

What level of training have you had regarding counterfeit parts issues?

- ○ I have no training on counterfeit parts issues
- ○ I have a little training on counterfeit parts issues
- ○ I have some training on counterfeit parts issues
- ○ I have substantial training on counterfeit parts issues
- ○ I have extensive training on counterfeit parts issues

To what degree do you think counterfeit parts are a problem for supply chains?

Counterfeit parts are not a problem for supply chains	Counterfeit parts are a minor problem for supply chains	Counterfeit parts are a considerable problem for supply chains	Counterfeit parts are a substantial program for supply chains	Counterfeit parts are an extensive program for supply chains
○	○	○	○	○

In your own work experience, have you ever personally dealt with a counterfeit parts situation? Check all that apply.

☐ I have unknowingly purchase a counterfeit product
☐ I have knowingly purchased a counterfeit product
☐ I know someone who has unknowingly purchased a counterfeit product
☐ I know some someone who has knowingly purchased a counterfeit product
☐ My company has received counterfeit products

In your work experience, have you ever dealt with a counterfeit parts situation?

Never problem	One time	A few times	An ongoing
○	○	○	○

In your work during the past year, how many purchasing decisions have you made (include both individual and team decisions)?

What industry or government sector do you work in?

Which of the following best describes your current position

○ Top management ○ Middle management ○ Supervisor ○ Professional ○ Other

If you selected "Other" as your position level, please describe the position.

How many years of professional work experience do you have?

How many years have you worked in supply chain management or logistics?

How many years have you worked in purchasing?

What is the approximate annual dollar volume of purchases you are responsible for?

○ < $25,000
○ $25,001 - $50,000
○ $50,001 - $75,000

○ $75,001 - $100,000

○ > $100,000

What is the highest level of education you have completed?

○ High School / GED ○ Some college ○ Associate's Degree ○ Bachelor's Degree

○ Master's Degree ○ Post-Master's Degree ○Doctoral Degree

What is your gender?

○ Male ○Female

Is English your native language?

○ Yes ○ No

Please select your level of agreement with the following statement. Exemptions from required childhood vaccinations should only be on the basis of medical necessity.

○ Strongly Disagree

○ Disagree

○ Neither Agree nor Disagree

○ Agree

○ Strongly Agree

What is your age in years?

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